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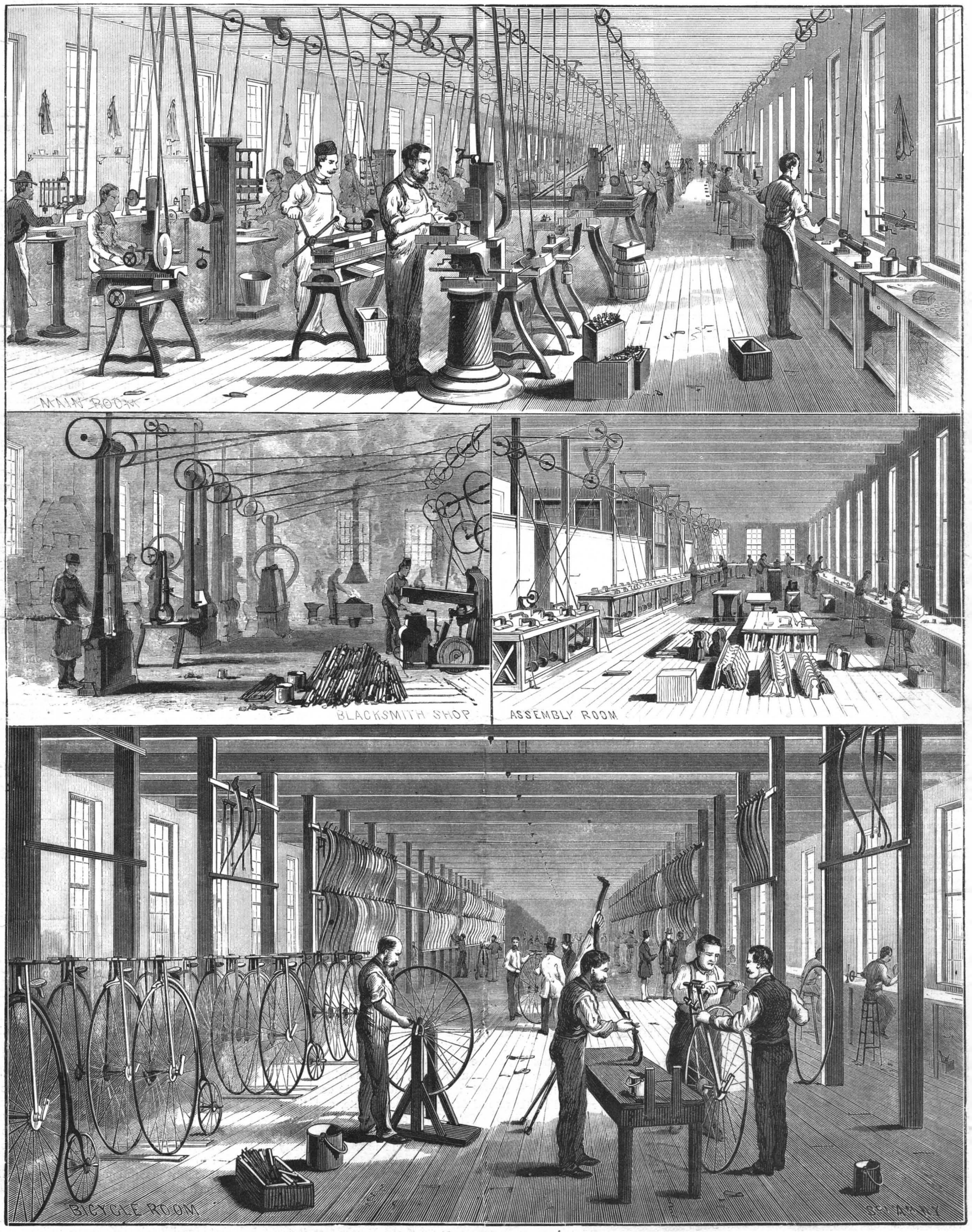

THE MANUFACTURE OF SEWING MACHINES AND BICYCLES.—THE WEED SEWING MACHINE FACTORY.—[See page 181.]

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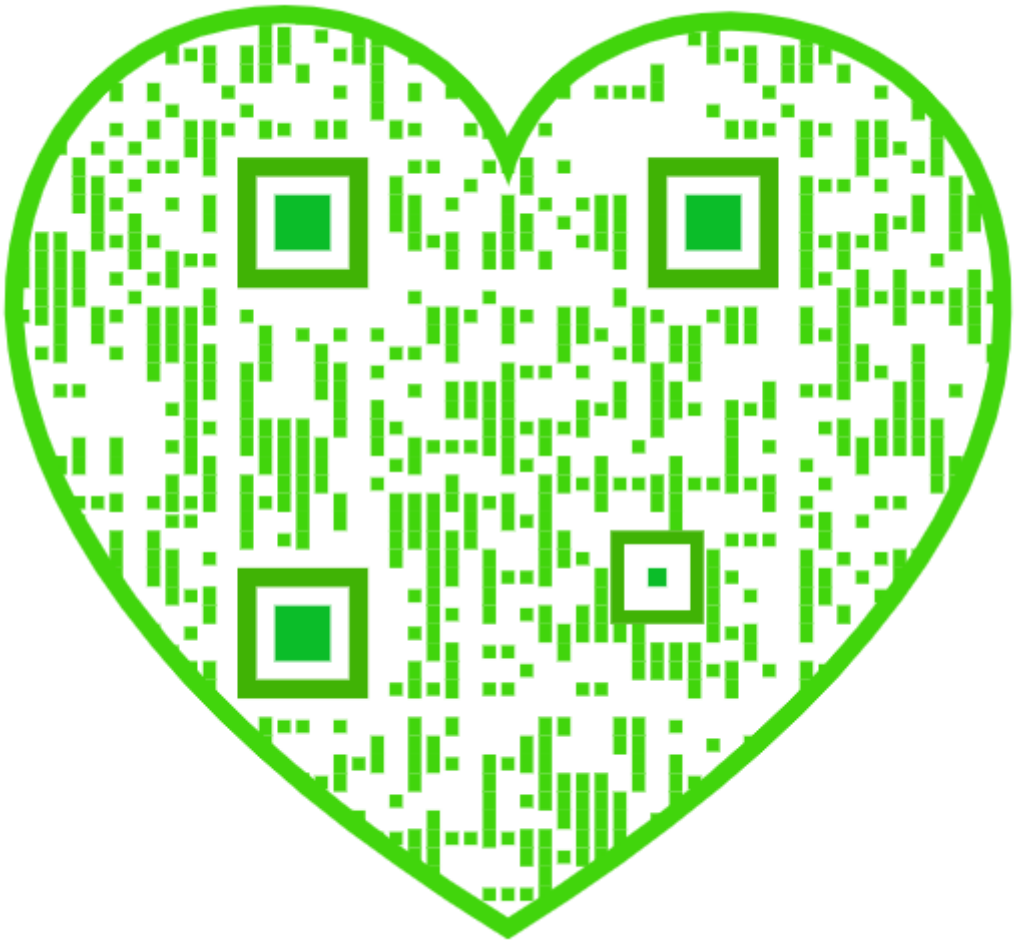

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THE ST. GOTHARD RAILWAY TUNNEL.

The junction of the northern and the southern sections of the St. Gothard tunnel was accomplished on the morning of February 29, thus bringing to successful issue the boldest and most difficult engineering work of the kind hitherto attempted.

The St. Gothard group of mountains comprise that part of the Alpine range in South Central Switzerland, directly north of the valley of Lake Maggiore, and separating the railway system of Switzerland from that of Northern Italy.

The project of tunneling Mount St. Gothard was a necessary consequence of the tunnel through Mont Cenis. Until that time most of the traffic and travel between Italy and Switzerland—in other words, a large part of the overland commerce between England, Belgium. Northeastern France, Western and Central Germany, and Northern Europe generally, on the one hand, and Italy on the other, and the Levant, as reached through the Italian ports—was carried on through Switzerland. The three great roads over the Swiss Alpine passes, the Simplon, the Splügen, and the St. Gothard, monopolized by far the larger part of this important trade. This monopoly was broken up when the Mont Cenis tunnel was completed in 1870, the bulk of the traffic and travel being thereby diverted through Western Italy, by way of France, to the inconvenience and loss of Northern and Central Europe.

Switzerland and Germany especially felt the need of restoring a more direct line of transit. The Simplon route was rejected because, like the Mont Cenis route, it would be directly tributary to France. The Splügen pass was less difficult than the St. Gothard, but the road leading to it must pass along the upper Rhine, in dangerous proximity to the Austrian frontier. The favorable geographical situation of the St. Gothard route, in the heart of Switzerland, more than offset, it was thought, its engineering difficulties, and it was therefore adopted. The entire length of the costly railway line, of which the St. Gothard tunnel forms a part, is 151 miles, 17 per cent of it being tunnels, and 1 per cent bridges and viaducts. The main tunnel is about 9⅘ miles long. There are twelve other long tunnels, ranging between 1,106 and 2,027 yards, and aggregating nearly ten miles in length; five tunnels between 220 and 550 yards in length; and twenty-five tunnels between 110 and 220 yards long. In all, there are fifty-two of these subsidiary tunnels, having a total length of 16 miles. The line is also carried over sixty-four bridges and viaducts, the longest, at Cadenazzo, in Tessin, consisting of five spans of 55 yards each.

The main tunnel traverses Mt. St. Gothard between Goeschenen on the north side and Airolo on the south. The contract for its construction was awarded to M. Louis Favre, of Geneva, August 7, 1872. The work was begun at Airolo the following month, and at the other end in November. The time set for the completion of the great task was eight years—six months more than the time actually employed.

Airolo station is 3,757 feet above the level of the sea, and Goeschenen 3,639 feet. The tunnel runs straight between these two points, except for 158 yards at the Airolo end, where a curve connects the tunnel with the station. The tunnel has been constructed for two lines of way, 4 feet 8½ inches gauge, the contract calling for a cutting of horseshoe form, 19·68 feet high by 24·93 feet wide at the level of the sleepers, and 26 24 feet at the springing of the arch, 6½ feet above the sleepers. The arch is a complete semicircle of 4 meters radius. The sides are curved to a radius of 33·13 feet. Where the rock was solid the tunnel was cut to the exact section without masonry.

The line of the tunnel rises from both ends to a summit level 197 yards in length; the northern gradient, for 8,128 yards, rising at the rate of 1 in 172; the southern gradient, 1 in 1,000, for 7,970 yards.

Before the work was begun, Professor Fritsch made a careful study of the strata to be pierced, and expressed the opinion that the principal mass to be traversed consisted of gneiss rich in mica; mica schist, gneiss, and hornblende-schist. These, he believed, extended through the mountain in the form of a fan, and he figured the amount of each as follows:

	Meters.
Granite gneiss, more or less homogeneous	2,200
Gneiss, more or less schistous	450
Crystalline limestone and gray marble	350
Micaceous schist passing into gneiss	1,300
Gneiss rich in mica passing into mica schist	6,600
Mica schist with hornblende	1,600
Gneiss more or less schistous	270
Mica schist, with veins of quartz	800
Hornblende schist	1,250
Dolomite, gypsum, etc	100

The nature of the rock met throughout went, in the main, to justify the Professor's prophecies. The material taken from the opposite ends differed widely. At the north end a layer of very hard rock was first met; hardly any water came from the roof, and but little timber was needed. At the southern extremity, on the contrary, the dominant rock was mica-schist, with numerous fissures, through which water leaked into the tunnel in great quantities. At one time it rushed in at the rate of 420 gallons per minute, and brought with it masses of *débris*. Later on, when beds of clay were struck, it rushed in at the rate of 2,640 gallons per minute. One hundred and eighty yards in a spring was met, which delivered 1,000 gallons a minute, and stopped the work for several days. The leakage kept varying from time to time, and at that side always giving much trouble to the workmen.

The headings were about eight feet square, giving frontal areas of sixty-seven and a quarter square feet. For the first half year they were driven by hand; after that, mechanical perforators, operated by compressed air, were employed. Full descriptions of the various devices of this sort, adopted during the progress of the work, with much detailed information touching the methods of working, rates of speed, cost of excavation, and so on, will be found in the several volumes of the SCIENTIFIC AMERICAN SUPPLEMENT, with many illustrations of the machinery employed and of the general engineering features of the work.

For the most part the air for the rock drills and for ventilating the tunnels was compressed by water power. At the north end of the tunnel the river Reuss furnished an abundance of water with a fall of 385 feet. This was utilized by means of turbines. On the south side water was scanty, so that it became necessary to work under a fall of nearly 600 feet. The turbines operated 16 air compressors at each end of the tunnel, supplying air enough under a pressure of 8 atmospheres to work from 18 to 20 drills, and to thoroughly ventilate the tunnel. About 600 pounds of dynamite were used daily, and, latterly, as many as 4,000 men were employed.

Many changes were made in the apparatus employed during the progress of the work, and great improvements were introduced. The temperature of the air in the tunnel was found to be always higher than that without. It steadily increased as the excavation proceeded. On the first day it rose from 35° Fahr. to 58°, while the air outside remained at 34°. The average temperature further in was found to be over 70°, while the rock was also much warmer than the surrounding atmosphere. Large bell exhausters were erected at each end of the tunnel for the removal of atmospheric impurities, although artificial ventilation was not needed until the boring was 1,000 meters deep. About 5,000,000 cubic feet of compressed air were forced into the excavation each day from either end, and an exhauster, capable of extracting 16,500 cubic feet per minute, was provided at each.

The contract price for the work was $196.40 a foot, tunnel complete; the work to be done October 1, 1880. For every day beyond that time the contractor was to forfeit $1,000 for the first six months, and $2,000 for each day of the second half year; a year's delay forfeiting the contract and the $1,600,000 deposited by the contractor's friends as security. On the other hand, a premium of $1,000 a day was allowed for each day gained upon the contract time. Accordingly there is due the contractor's successors the snug little premium of $215,000 for the early completion of the work.

Unfortunately the original contractor, M. Favre, did not live to see the accomplishment of his heroic task. While showing the levels to a French engineer, Saturday morning, July 19, he suddenly complained of a cramp, called for a glass of water, and fell down dead from an affection of the heart.

The prospect of losing by the St. Gothard route a large part of the traffic which now passes through the Mt. Cenis tunnel, has driven the French to urge the subsidizing of a project for piercing a still greater tunnel on the Simplon route.

The proposed tunnel strikes the mountain at a lower level than was thought of when the St. Gothard tunnel was projected; and, although its length will be greater, the conditions are so favorable that no doubt is felt in regard to its possible execution. Competent geologists pronounce the rocks of the Simplon less hard than those of St. Gothard, and predict that the work will suffer less from the infiltration of water. There is, besides, abundance of water power at both ends of the tunnel; and from their lower altitude the works will be less liable to interruption by the severity of the winter cold.

The railway extending from Lausanne up the lower part of the Rhone Valley is without curves, while the gradient nowhere exceeds 1 in 100. At its exit on the southern side of the mountain, in the Diviera Valley, the gradient is somewhat stronger—13 in 1000. In fact, when the tunnel is completed, the highest point of the line between Paris and Milan will not be in the Simplon, but between Dijon and Lausanne.

The tunnel will be over 12 miles in length, as compared with the 9 1-3 miles of the St. Gothard, and the 7½ miles of the Mt. Cenis tunnels; and as it is estimated that a daily advance will be made of 9 to 10 meters in the boring, so that the completion of the work is promised in 6 or 7 years after it is fairly begun.

The superior rate of progress in the St. Gothard tunnel over that in the tunnel of Mt. Cenis (9 1-3 miles in 7½ years, against 7½ miles in 13 1-3 years) was due mainly to the great improvements made from time to time in the machinery and explosives employed. The projectors of the Simplon tunnel count on a continuance of such inventive progress.

THE PATENT BILL NOW BEFORE THE SENATE.

We have heretofore pointed out the disingenuousness of the proposed new law, "To regulate practice in suits brought to recover damages for infringement of patents," the injustice it would certainly work to all who have property in patents, its practical confiscation of vested rights in what are assumed to be matters of only small concern to the owners, and the fairly doubtful question of its constitutionality, if tried on a broad issue in the tribunal of last resort. There is little satisfaction, however, to be derived by the owners of patents from the latter consideration, although it ought, indeed, to furnish a leading argument for the de-

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feat of the bill; but, should it once become law, there is little doubt that its provisions would be generally sustained by the lesser courts throughout the country, and it would be many years, and only after it had done about all the injury possible, before a final reversion might be obtained.

It has also been shown that the passage of the bill through the House was effected by a sort of *coup d'état* "in the interest of the Western farmers!"—and that no consideration of its provisions was had in that body; it did not come from the Committee on Patents, which has from time immemorial had charge of such matters, and was passed with a very light vote, under the assumption that it covered nothing of essential consequence. It did not matter that Congress had heretofore, for two or three years, given a great deal of attention to the question of the revision of the patent laws, and that the Senate had ably canvassed the whole ground before passing a bill which the House summarily rejected; all of this goes for nothing, and the House, taking not more than five minutes' time therefor, passes a bill whose practical effect would be even greater than that of the previous Senate bill, and which cannot fail, if it become law, to work an almost complete confiscation of the property of thousands of patentees.

The proposed law is undoubtedly in the interest, and is the immediate, though skillfully concealed work, of a powerful combination of monopolists. The influence of great moneyed interests in shaping legislation, national as well as state and municipal, has undoubtedly been on the increase of late years. The great corporations and combinations of capitalists which now exist have only lately attained their present gigantic proportions, and, though the manner in which they work to compass their ends is partially understood, the far reaching scope of their schemes is almost beyond ordinary comprehension. There are so many "wheels within wheels" in the complex machinery they employ, that it is always difficult, and often impossible, to decide whence the power is derived, and precisely what object is to be attained. The effort to put through the proposed new patent law, the dexterity with which it was managed in the House, and the plausible and "taking" reasons at once given to the public for the urgent necessity of such a measure, show the way in which this department of their work is attended to. To suppose that the real reason for the passage of the bill was the one given—that it was simply a measure for the "protection of farmers"—would be ridiculous. But to find out exactly who are the parties working so strenuously for the passage of this law, how they have attained their present measure of success, and how much a complete victory would be worth to them in dollars and cents, would be to discover a portion of their work which it is their main object to cover up. A large proportion of the users of patented devices would prefer to pay an equitable price for the value they in this way receive, and in this fact lies the primal strength of our patent system. Any persistent and determined effort, therefore, to confiscate the rights of patentees, cannot have a popular indorsement, and the intimation that "the farmers," whose benefits under our patent system have been so great, are the sponsors of this movement, is absurd on its face. This excuse, and this particular way of changing our patent laws, were not thought of until lately, although there has been, for a long time, a powerful interest working for such amendments as will make it more easy and safe to infringe upon the rights of patentees.

Among those who have most earnestly sought such changes, and who would be the greatest beneficiaries thereby, are the great railway corporations; the sop thrown to the "farmers" would be but a bagatelle to what they would gain, for the passage of such a bill as that now before the Senate would give them advantages whereby they might virtually confiscate thousands of patents involving details of construction and operation, in road-bed, bridges, cars, locomotives, supplies, etc. Certain large manufacturers of the Eastern States have also been very zealous in this work, from the success of which they would reap substantial benefits in escaping payment of fees on many minor patents.

The danger will not be over until the bill is taken up in the Senate and *defeated*, or so amended as to make another vote upon it necessary in the House. In the latter case, we may be assured, it will not again go through on a stolen passage. Meantime, and until some permanent disposition is made of the matter, it behooves all patentees, and all who are interested in the maintenance of any rights heretofore supposed to have been "secured" to them by our patent laws, to see that the members of the Senate are individually furnished with as many personal protests as the threatened enactment of so unjust a law ought to bring out.

Imitation Stained Glass—A New Idea.

A few years ago stained glass windows were rare in this country, even in churches, except among the ambitious and costly of those of two or three denominations. Now ornamental windows are comparatively plenty, not only in churches, but in other public and private buildings, and would be more common in ordinary dwellings were the cost within the scope of ordinary purses.

The growing taste for this sort of color decoration cannot fail to be materially advanced by the cheap and very successful imitation of stained glass effects now coming into use. Thin sheets of silk paper are printed with brilliant oil colors, in varied artistic patterns; and when pasted upon common glass windows they produce all the brilliant effects of costly colored glass. The color sheets can be applied without skilled labor, and show a great advance in decorative effects over ordinary curtain shades or blinds. The invention has been patented, and we predict for the product a large demand. The address of the manufacturer may be found in our advertising columns.

THE NEW METEORITE.

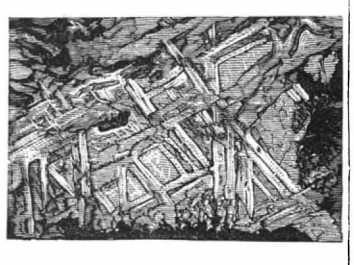
In our issue of March 6, we gave a brief account of a new meteorite, discovered near Chulafinne, Ala., by Mr. John F.

Meteorite from Chulafinne, Ala.

Watson, and now in the possession of Mr. Edison's expert mineralogist, Mr. W. E. Hidden, of Newark, N. J.

We now present our readers with a side view of this interesting object, and give a representation of the Widmannstaettian figures which it exhibits. Upon analysis of the meteorite, its constituents are found to be approximately as follows: Iron, 92 per cent; nickel, 7 per cent; phosphorus, about the same as ordinary steel; and of copper and carbon only a trace. It is about as hard as copper, and exhibits about the same tenacity under the cutting tool.

This in common with other metallic aerolites is very heterogeneous, as indicated by the marked figures developed on the polished facet by the action of nitric acid. Mr. Edison suggests that "These lines are without doubt a map of the streets of the New Jerusalem."



Widmannstaettian Figures on the Chulafinne, Ala., Meteorite.

Meteorites of this size (31 lb.) are not extremely rare, and they have been found of all sizes, weighing from a few ounces to 25 tons. It is now generally conceded that these strange bodies fill the spaces between the orbits of the planets and swing around the sun like so many miniature worlds, until by unexplained causes they are brought within the attractive influence of the larger planets, when they gravitate toward the superior body.

Kepler's idea that there were more small bodies flying about in space than there are fishes in the ocean, seems to find support in modern discoveries.

The Great Iowa Meteorite.

This great meteorite, which fell in Iowa the early part of last year, is thus described by Professor Thompson, of the Minnesota State University, in a recent astronomical essay: May 10, 1879, was a bright, clear, cloudless day. At 5 o'clock in the afternoon, in full sunshine, this meteorite passed through the air, exploded, and fell in the town of Erterville, Emmet County, Iowa, about ten or twelve miles below the southern boundary of Jackson County, Minn., in latitude 43° 30′ north, longitude 94° 50′ west from Greenwich. The path it followed marked a course from northwest to southwest, and was seen for a distance of several hundred miles. Its appearance in the heavens was that of a huge globe of fire, attended by a fiery cloud. The people who saw it were greatly alarmed; not more at the flying ball of fire which seemed no near to them, than at the terrific explosions immediately above them; those who did not see it thought an earthquake had occurred, and were in great terror. The noise accompanying its flight is described as rumbling, cracking, crashing, similar to that produced by a train of cars crossing a long bridge; then came a very loud report, followed immediately by two distinct reports in quick succession, though not so explosive or loud as the first. It struck the ground in separate masses, together with smaller fragments scattered over an area of three or four miles. There were two large pieces which fell about two miles apart.

The largest mass, weighing 470 pounds, now at Keokuk, Iowa, penetrated a hard blue clay soil, to the depth of twelve feet. Another mass, weighing 170 pounds, now at the State University, fell on a dry grassy knoll, and was buried to the depth of 5½ feet. A few rods from the largest mass was found a fragment weighing 30 pounds, and a schoolboy picked up a specimen weighing three pounds. The form of all the pieces is like that of rudely detached masses from a quarry, or ejected from the mouth of a volcano. The mass in the museum of the university has an irregular rhomboidal outline, about 15 by 18 inches, of an average thickness of 6 inches, and when first obtained was covered, as most meteorites are, with a black shining coat or crust. The largest mass is not so regular in its formation. It is more ragged and bristles with points of nickeliferous iron. Professor Heinrich, of the Iowa State University, pronounced it the more valuable of the two large masses; but a full analysis will probably determine them to be one and the same. While the nickeliferous iron seemed more abundant in the largest, the crystalline formations are far more numerous in the smaller.

THE FIRST STEP IN INVENTION.

A correspondent, who has had some experience as an inventor, suggests that the SCIENTIFIC AMERICAN should regularly set apart a portion of its space for the outlining of inventions needed. This for the purpose of setting inventors "on the right track," and so laying out their work, that they may "go immediately at the thing wanted."

To a considerable extent the SCIENTIFIC AMERICAN has always made a practice of suggesting, whenever it could, opportunities for invention; and not unfrequently such suggestions have been successfully worked out and patented by wide-awake readers. Further opportunities of the sort will be gladly taken advantage of; and pleasure will also be taken in presenting the suggestions of any who clearly perceive the need of and opportunity for specific improvements in any art or manufacture, but are unable, for lack of time, means, or inventive capacity, to undertake to work out the needed invention.

Such suggestions, however, our correspondent will readily understand, are not likely to be numerous. Our countrymen are by habit as well as by nature, inventors; and when one sees a chance to better any process or product he is very sure to keep his knowledge to himself for future developments. It is mainly in connection with inventions requiring a large outlay of time, labor, or money, or all three, that men voluntarily give away ideas of value. However original and valuable, such ideas are not apt to be salable; while only the more courageous and forehanded among inventors dare attempt to develop them materially.

Opportunities for working out such costly and complicated inventions are obviously of little use to the class of inventors which our correspondent has in mind. What he wants is specific information touching this, that, or the other clearly felt deficiency in the means or methods of one or other of the arts, deficiencies which the would-be inventor could supply if he only knew what was wanted.

Such deficiencies are doubtless infinite in variety and number; but, for the most part, it is the business of the inventor to discover them, as well as to invent the remedy; and, in most cases, his acuteness is chiefly manifested in detecting the opportunity for a useful invention. The arts are full of improvable means and methods, and of openings for entirely novel processes. As a rule, it is the inventor of the future who will first detect where the needed improvements and substitutions should fall; and in this his genius will be chiefly displayed. The development of the inventions will be a secondary and comparatively simple work.

Accordingly, the faculty which the young inventor should cultivate most sedulously is the faculty of critical observation. He must learn to look upon everything in two aspects—first, to see exactly how it appears, how it was produced, and how it works; second, to see how its appearance, its working, or the manner of its production can be improved, simplified, and cheapened, or its uses extended; or whether something entirely different would not answer the purpose better. With the cultivation of this faculty the inventor's difficulties arise not from the lack of opportunities to invent, but from their multiplicity, and the need of restricting his thoughts and constructive labors to such novelties as are likely to be profitable.

In short, the young would-be inventor must begin further back even than Mrs. Glasse advised in her famous receipt for cooking the hare. He must not merely "catch the hare," but he first must learn how to catch hares and where they are likely to hide. After that the catching and cooking are easy.

THE telephone has been found by Herr Niemöller (*Wied. Ann.*) capable of determining very quickly and accurately the resistance of liquids. It is substituted for the galvanometer in a galvanic bridge, and an induction current is used; then, if the resistances compared are a large liquid resistance on the one hand, and a Siemens resistance box on the other, so that the electro-dynamic constants of the branches are very small; if, further, a German silver or platinum wire be used as measuring wire, it is found that in the position where the galvanometer shows no deflection, the tone in the telephone has a well-marked minimum of intensity. Supposing the liquid resistance has 2,000 units, a variation of it, even 4 units, reveals itself in a displacement of the minimum position.

AT the present time there is annually manufactured on the Mississippi River and its tributaries about 1,500,000,000 feet of white pine lumber, with its proportionate accompaniment of shingles, laths, and pickets. This is mostly consumed west of the river, and finds its way to Texas, Kansas, and Nebraska, and even to Colorado. St. Louis receives more lumber annually than any other point on the river, but after deducting the amount required for home consumption, Hannibal distributes more for foreign consumption than St. Louis.

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Improved Surveying Instruments.

Mr. T. A. Matsdaira, C.E., a native of Japan, now of this city, is the author of several improvements as above. One of his instruments consists of a steel plate, upon which a bar graduated to fine divisions upon a scale of ten is fastened. At one end, so arranged as to slide upon this bar to any position, is a semicircular plate, with its circumference divided into degrees, minutes, and seconds. At the other end is a similar plate, a quadrant in form. At the center of these a movable bar is arranged to turn like a pointer and indicate the angle. Each is graduated to the same scale as the first bar. To find the required element of a triangle, it is only necessary to revolve the bar on the semicircular plate if the angle is obtuse, and upon the quadrant if it is acute, until the proper angle is indicated. With the other bar the given side is placed so that a triangle similar to the one to be solved is shown, and then the required angle can be read off from the plate. This is applicable whether one side and the adjacent angles, or one angle and the adjacent sides, or one angle and the opposite sides of a triangle are given. The result is obtained at a glance and in a few seconds, while the use of common trigonometrical calculations by sines and cosines involves the use of tables and takes much time. If the instrument is made with the accuracy attainable now in the construction of scientific apparatus, the result, the inventor claims, will be correct.

DISTANCE FINDER.

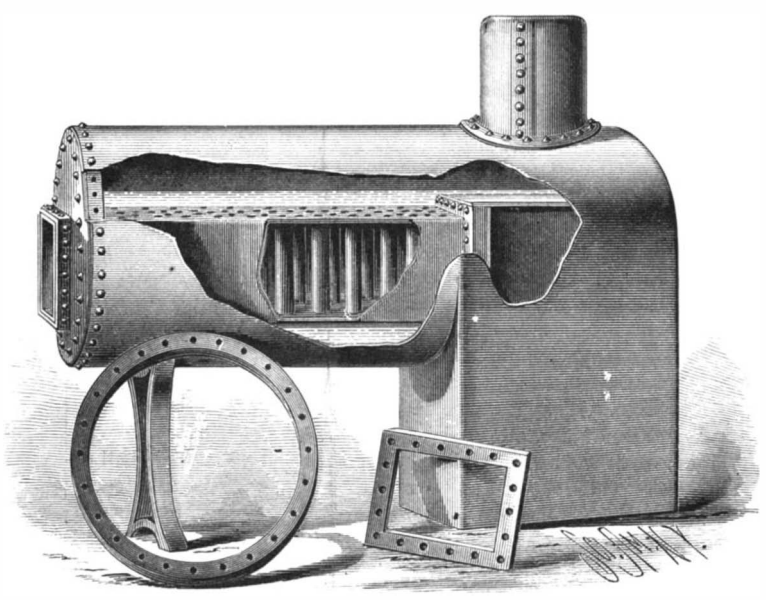
The same inventor makes an instrument for finding distances, which consists of a finely graduated brass or steel plate, two feet in length. It has a slot in the center and a movable support, to which a telescope is attached, which may be firmly fixed by a thumb screw. If, for instance, the distance of an object across a lake is sought, the instrument, which has five spirit levels to secure perfect accuracy, is placed in position, and the telescope is sighted upon the object and firmly attached to the support. It is then moved in the slot two feet to the other end of the plate, and another object is now noted through it. With this object in mind, the telescope is moved back to its first position, and turned until this second object is seen through it. The variation from the line of its first direction gives an angle of, a triangle, at the other two angles of which are the two objects. By means of the first mentioned instrument the second angle and sides of the triangle are measured, and hence the distance of the first object is secured.

Another device for finding the distance of an object in a different way is also described by Mr. Matsdaira. The plate, two feet in length, has a fixed telescope at one end. At the other end, upon the arc of a circle, whose sections are four feet, another telescope moves, and has a pointer, which directs to a graduated scale at a tangent to the arc. When the two telescopes are both directed to the distant object the pointer indicates a certain number on the scale, which is divided down to $\frac{1}{32}$ of an inch. A table accurately prepared shows to what distance these numbers refer, and by looking on it the distance is ascertained.

IMPROVEMENT IN BOILERS.

The accompanying engraving represents an improved boiler recently patented by Messrs. J. D. Ogle and R. A. Burnett, of Washington Court House, Fayette county, O The boiler is constructed with a view to a perfect and natural circulation of water, and is arranged so that all of the tubes, together with the tube sheets, may be easily removed from the boiler shell for cleaning or repairs. The flues or tubes are arranged vertically in a rectangular flue box, provided with a rectangular flange, which is bolted to a corresponding collar surrounding an opening in the rear wall of the fire box. The rear end of the flue box is riveted to the back head of the boiler, and the latter is secured to an internal flange in the boiler shell by bolts. The joints at the ends of the flue box are very strong, and capable of withstanding any strain that can be brought to bear upon them. The flame, smoke, and products of combustion pass through the flue box and around the flues, effecting a rapid generation of steam. The circulation of the water and steam in the vertical tubes is natural and perfect.

When occasion requires the removal of the tubes for cleaning or any other purpose, the bolts are removed from the rear head of the boiler and from the rectangular flange surrounding the forward end of the flue box, when the flue box, with the entire series of tubes, may be withdrawn from the boiler shell. In cases of boilers carrying a very high pressure, the flue box may be strengthened by stay bolts in the usual way. The advantages of this style of boiler will be apparent to any one familiar with the subject of steam generation.



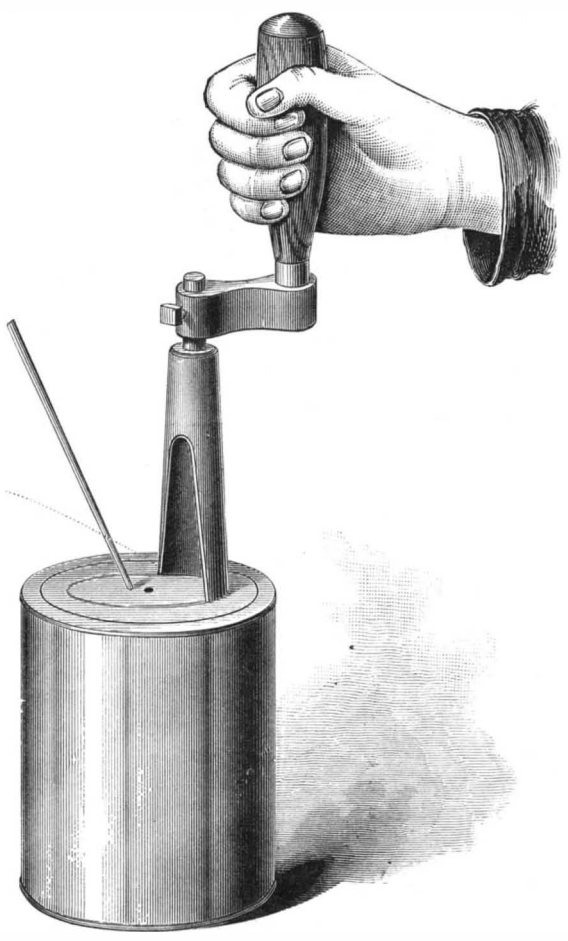
OGLE AND BURNETT'S IMPROVED BOILER.

Tobacco Chewers not Wanted.

It is a well known fact that tobacco juice contains nicotine acid, a sort of tannate, very refractory in dyeing. The *Textile Colorist* says: It has just been discovered in Europe that stains and imperfections, unaccounted for so far, on various goods submitted to careful dyeing, were caused by the salivation of chewing workmen, especially weavers. Any moisture containing tobacco extract falling upon tissues of mixed materials, such as wool and cotton, notably in raised goods, as velvet, plush, blankets, etc., will create spots deeper in shade than the ground color, as if acted on by a stronger mordant. Manufacturers have been obliged to apply on an extra tannin mordant and redye many pieces of goods on account of this defect. Strict regulations against this ill use of tobacco salivation have been enacted in several establishments as a remedy for this curious inconvenience.

NEW SOLDERING TOOL.

The annexed engraving represents a modification of the ordinary soldering iron, intended to be used in capping or



PAINTER'S SOLDERING TOOL.

sealing provision cans. It facilitates the operation of soldering, and dispenses with the use of revolving tables and the complicated mechanism usually employed for the purpose. The invention consists in a can soldering tool, having a soldering edge curved to conform to the groove in the can cover designed to receive the solder, and a handle located at one side of the axis of the tool, so that while the rotation of the tool is dependent upon a rotary motion of the handle about the vertical axis of the can, its working edge is guided by the groove in the top of the can, to which it conforms. This invention was recently patented by Mr. William Painter, of Baltimore, Md.

Malleable Bronze.

Dronier claims to have discovered a simple method of rendering bronze as malleable as copper, iron, etc. This consists in the addition of a very little mercury—½ to 2 per cent. It seems to act mechanically rather than chemically. The mercury may be combined with one of the metals of which bronze is made, before they are combined, by pouring it into the melted metal and stirring well, or it may be put into the melted copper along with tin, or just after the latter has been added, or an amalgam of tin is stirred into the melted copper.

MECHANICAL INVENTIONS.

Mr. James J. Dubois, of Springtown, N. Y., has patented an improvement in wagon running gear, the object of which is to furnish wagon reaches constructed so that they may be screwed into the rear axle and the head block, and may be guarded from being worn by the forward wheels in cramping the wagon.

An improved ore feeder for stamp mills has been patented by Mr. Isaac B. Hammond, of Deadwood, Dakota Territory. The object of this invention is to furnish an improved machine, so constructed as to feed the ore to the mortars as it is required, automatically. It may be adjusted to feed more or less ore, as required.

Mr. Wade P. Wood, of Leon, Iowa, has patented a novel automatic brake for wagons. This invention is an improvement on the brake for which letters patent No. 206,063 were granted to the same inventor July 16, 1878. The improvements render it more satisfactory in use and more reliable in operation.

Mr. William Huey, of Cambridge, Md., has patented a machine for cutting blanks from a block of wood and simultaneously grooving it preparatory to bending it into form for making the rectangular sides of a box. The invention consists in the arrangement of a stationary horizontal knife bolted strongly to a bed frame, so that it cannot bend when under strain; an adjustable gauge plate with groove cutters arranged just in front of the knife and enough below its edge to give the proper thickness of blank, together with a reciprocating block carrier.

Mr. James A. Knetzer, Sr, of Fillmore, Ind., has patented an improvement in the class of wagon brakes in which the sliding brake bar is adjusted by a rock shaft hung on the rear axle, and having on its inner end an arm from which a rod extends forward to the brake bar. The improvement pertains to the construction of the lever which operates the rock shaft, and the construction and arrangement of the device which connects them.

A firm and easily applied device for fastening handles to axes and other tools, has been patented by Mr. Andy E. Tangen, of Bismarck, Dakota Ter. It consists in fastening the handle in the eye of the ax or tool by means of spring straps adapted to clasp the ends of the handle inserted in the eye, and a bolt inserted into the eye from the end opposite the handle, so as to engage the spring straps.

Mr. John Houck, of Tobyhanna Mills, Pa., has patented improvements in feeding mechanism for tubular cutter-heads used for turning broom handles, curtain rollers, umbrella handles, and other wooden articles of cylindrical form. Such machines have heretofore been fitted with feed rollers fixed at the front and back of the hollow mandrel to carry the sticks through, and in case of the sticks breaking, or when for any reason access was required to the mandrel, considerable time and labor were involved, as the rollers or the mandrel had to be removed from their bearings. The object of this invention is to fit the feed rollers so that access may be had to the cutter readily without disconnection of the parts.

A combined rule, square, and gauge for carpenter's use in framing, has been patented by Mr. Mahlon B. Cornell, of Philadelphia, Pa. The object of the invention is to furnish an implement adapted for carrying out all the purposes for which the ordinary square is used with greater facility, convenience, and accuracy.

Mr. Lucius S. Edleblute, of Cincinnati, O., has patented an improvement in the class of metal wheel hubs in which the spoke tenons or butts are clamped between flanged collars, one of which is adjustable on the axle box to adapt it for convenient adjustment or removal. By the peculiar construction and arrangement of parts the inventor forms a very firm, strong, and durable hub, whose parts may be readily put together or taken apart, and which is adapted to carry a comparatively large supply of lubricant.

An improved vehicle axle, patented by Mr. James Conniff, of Oconto, Wis., consists of an axle made of cast iron in a cylindrical form, and divided off at each end into compartments, in which are placed rollers in a circle, so as to form a bearing for the spindles which are inserted in the ends of the axle. The spindles are held in the axle by collars, which rest in one of the compartments between balls, which hold them steadily and prevent endwise motion without producing much friction.

Mr. Jacob Mollet, of Liberty, Mo., has patented an improved vise for holding saws while being filed, which is simple, convenient, and so constructed that the whole of one side of a saw can be filed without moving the saw. It may be used for holding hand saws, crosscut saws, and circular saws with equal facility.

Coffee in Typhoid Fever.

Dr. Guillasse, of the French Navy, reports that, in the early stages of the disease, coffee is almost a specific against typhoid fever. He gives to adults two or three tablespoonfuls of strong black coffee every two hours, alternating with one or two teaspoonfuls of claret or Burgundy wine. The beneficial effect is immediate. A little lemonade or citrate of magnesia should be given daily, and after a while quinine.

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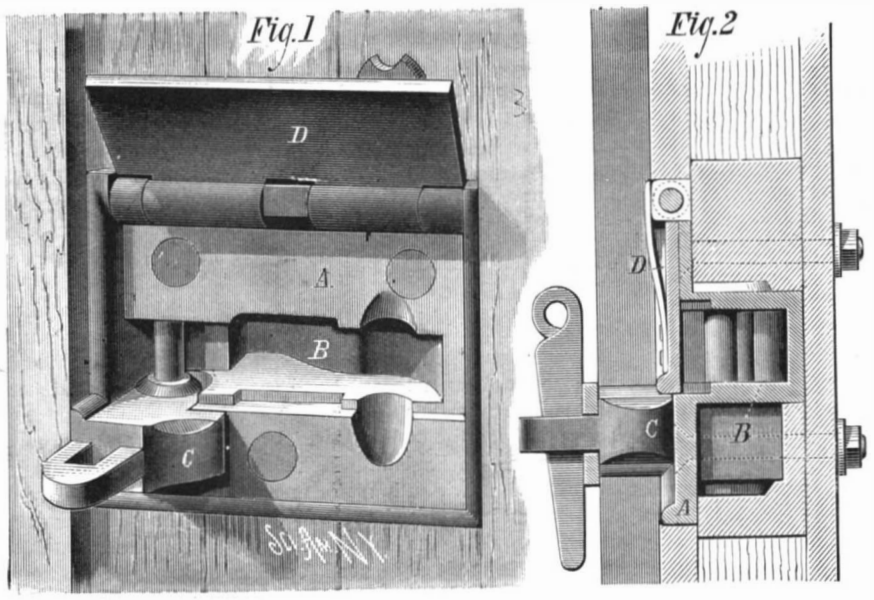
NEW CAR DOOR FASTENER.

We illustrate herewith a novel and effective car door fastener, patented by Messrs. William H. Buser and Burrell L. Shaw, of Denison, Texas. It is designed to afford a positive means of fastening car doors and, at the same time, to dispense with the cleat which is commonly used for stopping the door and which is so damaging to the side of the car.

An iron box, A, secured to the side of the car, has a recess, B, capable of receiving the staple block, C, which is pivoted on a vertical rod extending through the box. The recess, B, has a vertical branch into which the pivoted end of the staple block, C, may drop when the block is swung around at right angles with the face of the box, A, and when in this position it acts as a rigid stop for the door. It has a staple formed on its outer end to receive a hasp attached to the door and a lock or pin for securing the hasp. When the fastener is not in use the staple block, C, is raised up and turned upon its pivot until it is wholly within the recess, B, when the door, D, is closed, making all flush with the side of the car. The door is also closed when the fastener is in use, excluding dirt, snow, or ice, from the recess, B.

This fastening is very strong and well calculated to withstand the rough usage to which it must be submitted.



BUSER & SHAW'S CAR DOOR FASTENER.

SPEAKING PICTURE BOOK.

The engraving represents a novel toy recently patented in this country by Mr. Theodor Brand, of Sonneberg, Germany.

BRAND'S SPEAKING PICTURE BOOK.

The invention consists of a device combining, in book form, pictures of animals and human beings, and mechanism for producing sounds in imitation of the voices of the beings represented.

The book contains a number of picture sheets, having on the reverse side the text referring to the picture on the preceding page. A part of the text page is shown in the engraving with the title, The Rooster, referring to the opposite page.

A portion of the book is broken away to show the mechanism beneath, which consists of bellows and whistles of well known construction for imitating different voices. The bellows are operated by the strings which project through the edge of the book, and are provided with buttons for convenience in operating the toy. By pulling the particular button belonging to the picture being exhibited, a sound is produced which imitates the voice of the subject represented.

ENGINEERING INVENTIONS.

Messrs. John Boyd, of Baltimore, Md., and Roy O. Crowley, of New York city, have patented an electrical water indicator for steam boilers, by means of which changes in the height of the water in a steam boiler may operate an electro magnetic apparatus to open and close the feed water pipe of a steam boiler, to admit and shut off the feed water automatically, as required, and to sound an alarm.

Mr. Eli Shafer, of Sigourney, Iowa, has patented an improved car coupling, consisting of an open mouthed drawhead, within which is a flat headed drawbar encircled by a strong spiral spring to force it outward. In the face of the head of the drawbar there is a transverse rectangular groove, within which the flattened end of the link is placed and held by a metallic block. The coupling has other novel features which cannot be explained without engravings.

An improved rotary engine, patented by Mr. James A. Adams, of Lampasas, Texas, consists, essentially, of a wheel provided with radially sliding pistons, and revolving within a fixed circumferential steam chest, and having fixed on its axle an eccentric and spring that operate to throw the pistons or floats outward to receive the pressure of the steam.

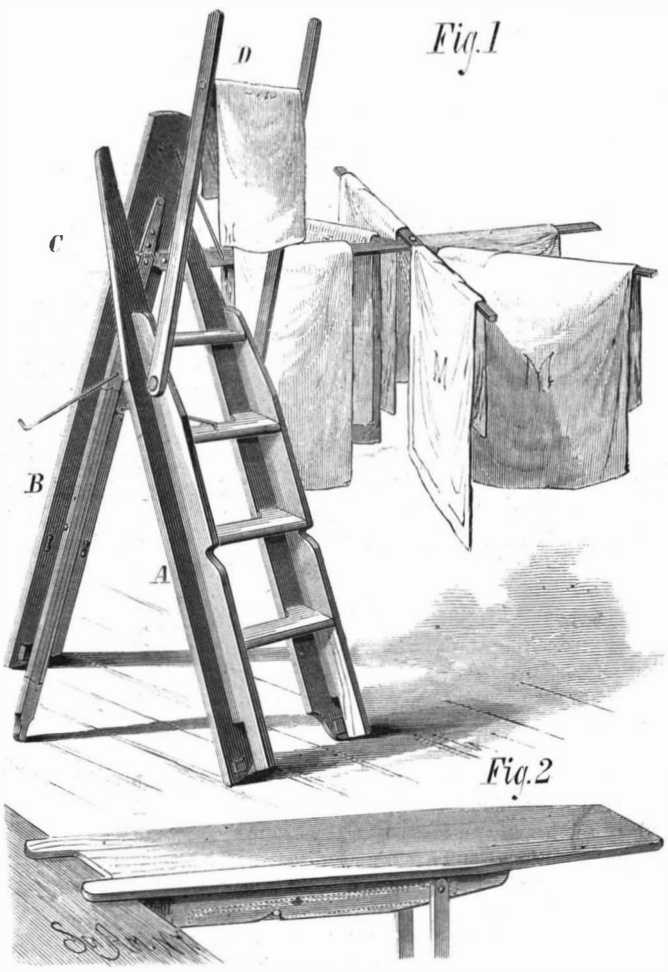
An improved car coupling has been patented by Mr. Horace E. Henwood, of Hamilton, Ontario, Canada. This invention is an improvement upon the automatic car coupling, forming the subject of United States letters patent No. 143,011; and it consists in a novel construction and arrangement of parts which cannot be explained without engravings.

Messrs. James P. Meredith and John S. Lyon, of Augusta, Ga., have patented an improved railway safety switch, in which the continuity of the main line is not broken and the use of frogs is dispensed with. The invention consists in the novel arrangement of jointed leading tongues, a lap rail section for crossing the main track, and movable guard rails, all connected so as to be operated at will, or by the wheels of the locomotive in passing over the track.

IRONING TABLE, CLOTHES DRIER, AND STEP LADDER.

The annexed engraving shows one of those novel combinations that may be used to advantage in any household. It comprises a convenient ironing table or skirt board, a strong step ladder, and a handy clothes drier.

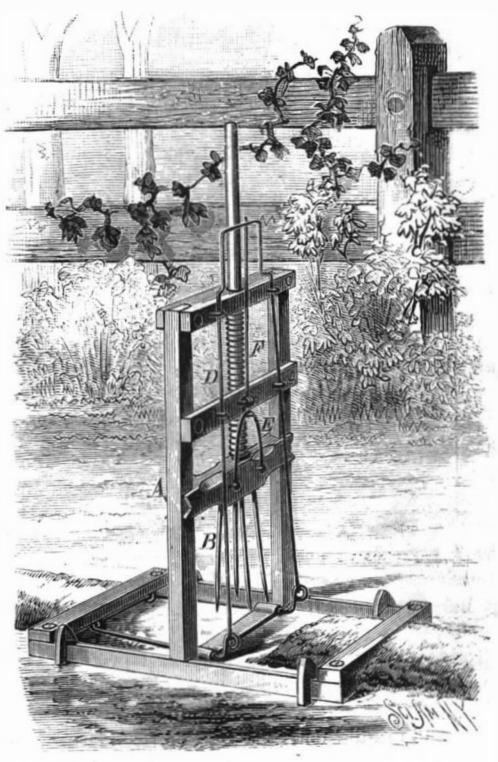
The body of the device consists of a board of the proper form and size for an ironing or a skirt board, divided into three parts, two of them forming, together with the steps and side rails, the ladder, A, while the third part is hinged to the other two, and forms the brace, B, which supports the ladder. Two lateral braces, C, are pivoted to the board, B, and are each divided into three pieces, two of which are pivoted to the main piece, so that they may be turned at an angle with it, forming a radial support for clothes. When the braces, C, are used for clothes drying, they are supported in a horizontal position by long hooks, which engage eyes in the under surface of the board, B. When they are employed to steady the step ladder they are folded compactly together, and their free ends are allowed to rest upon the floor. The legs, D, are pivoted to the side of the stepladder rails and are used as additional supports for clothes when occasion requires. When the device is used as an ironing table, the braces, C, are folded upon the board, B, and the latter is shut into the part, A. The legs, D, are then folded up, and the larger end of the board is placed upon a common table, where it is held by sharp spikes which engage the under surface of the table. The act of raising the small end of the ironing board forces these spikes into the table; the legs, D, being unfolded, the device is ready for ironing purposes, and appears as shown in Fig. 2. This ingenious combination was recently patented by Mr. J. H. Martin, of Hartford, N. Y.



COMBINED IRONING TABLE, CLOTHES DRIER, AND STEP LADDER.

NEW MOLE AND GOPHER TRAP.

The mole and gopher are great pests to the farmer and gardener, destroying enormous quantities of grain and doing great damage to gardens, lawns, nurseries, small fruit orchards, and young hedges. These animals are found in most parts of the United States, and, although they may not all be vegetarians, they actually destroy millions of dollars' worth of crops every year.



ROGERS' MOLE AND GOPHER TRAP.

As many of our readers know, it is the habit of the mole to travel just beneath the surface of the ground, in search of worms and insects, upon which it feeds. Its subterranean paths are usually formed so near the surface that a ridge appears, indicating the track of the animal, and where this ridge is the grass withers. If one of these ridges be pressed down with the foot, the mole, on its return, reopens its track, and in so doing, restores the ridge to its original form.

To get rid of moles and similar vermin, a great deal of ingenuity has been experienced and a large number of devices have been patented. Among the latter is the trap represented in the accompanying engraving, which seems to possess advantages not before accomplished. It is set across the mole track after the ridge is pressed down, and is sprung by the animal in its attempt to reopen its track.

The trap has a spring-acted follower guided by the vertical frame, A, and carrying four sharp tines or spikes, B. In the lower portion of the frame is pivoted a lever or trigger, C, which is jointed to the sliding wire frame, D. A bail, E, jointed to the follower is engaged by the catch, F, when the trap is set, and the long arm of the catch is retained by the upper part of the sliding frame, D.

A short section of the ridge of the mole track is pressed down by the foot and the trap is pinned down over the flattened place. When the mole returns it presses the lever, C, upward in the act of opening the path, thus releasing the catch, F, when the tines, B, spring downward and impale the ani-

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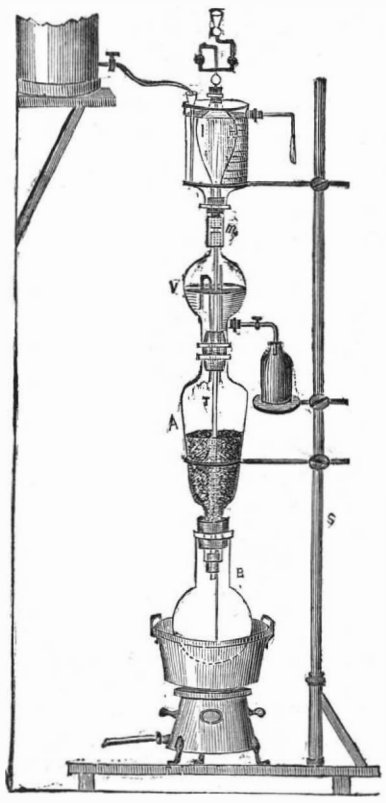
mal. For gophers the trap is fastened down over the mouth of the hole where he carries out earth. When it emerges with a load it presses up the trigger and springs the trap.

This useful invention was recently patented by Mr. Albert G. Rogers, of Lathrop, Mo., who will furnish further particulars.

APPARATUS FOR CONTINUOUS DISPLACEMENT.

To the long list of apparatus devised for continuous displacement or extraction, another has been added by Mr. G. Guérin, of Lyons. The flask, B, which has a wide neck, is intended to receive the volatile liquid used for extraction. Into the neck is fitted, by means of a tightly fitting cork, the percolator, A, containing the substance to be extracted. The percolator is connected with a globular receiver, V, containing three tubulures, the lateral one of which terminates in a stoppered bent tube, pointing into an empty bottle. Over the receiver is fixed a condensing apparatus, surmounted by a safety tube filled with mercury. The substance which is to be extracted having been introduced into the percolator, A, and a sufficient amount of the volatile menstruum having



GUERIN'S CONTINUAL DISPLACEMENT APPARATUS.

been introduced into flask, the apparatus is connected together, as shown in the illustration, and the water bath surrounding the flask, B, heated by means of the gas stove.

As soon as the liquid boils the vapors ascend through the central tube, T, into the pear-shaped receiver, I, which is kept cold by a supply of water. The upper part of the tube, T, where it passes through the joint, *m*, and through the neck of the condenser, is *not* in contact with the walls of the apparatus. Hence the condensed liquid flows down the sides of the condenser, I, into the receiver, V. The latter is provided with a small straight air tube and with a bent siphon tube, both communicating with the percolator below. As soon as enough liquid has accumulated in the receiver to rise over the bend of the siphon tube, it will begin to flow into the percolator, until the short leg of the siphon is clear of the liquid. The flow will then stop until it has risen to the former level. The liquid falling upon the substance in the percolator will penetrate it and finally pass into the flask, B, loaded with the soluble matters.

Fresh Meat from Australia.

On Friday, February 6, a number of visitors assembled by invitation of the firm of McIlwraith, McEacharn & Co., Leadenhall street, on board the Strathleven, one of Burrell & Son's line of steamers, now lying at the West quay, East India (Import) Dock, London, to inspect the "meat room" and the machinery, and to practically judge of the experiment of the practicability of bringing fresh meat by the freezing process from Australia, the first consignment of which came by this vessel.

On November 29 the vessel left Sydney, having on board 55 carcasses of beef and 357 carcasses of mutton. She proceeded to Melbourne, where an addition was made to that portion of her cargo by the shipment of 5 carcasses of beef and 205 carcasses of mutton, the total weight being from 30 to 33 tons. The Strathleven is 1,588 tons register, 2,436 tons burden. She left Melbourne on December 6, passing through the Suez Canal, and arrived at London on Monday, February 2. The whole of the meat must therefore have been killed about two months since. The chamber in which the carcasses were stored is about 26 feet square, and 6 feet 6 inches in height, and connected with it is an engine fitted with refrigerating apartments, the air being drawn out of the room, compressed, and chilled, and then forced back again through about 300 feet of piping. By these means an average temperature was kept during the voyage of from 10 to 15 degrees of frost; on Friday, although until the middle of the day the engine had not been at work since Sunday or Monday, the temperature was 23° Fah. About 3 tons of butter were also brought over in the same department. The vessel was 23 days in the tropics, and in the Red Sea the temperature was from 72° to 74°, but no difficulty was experienced in keeping the "meat room" at 12° of frost. It was not found necessary to have the engine constantly at work, and no chemicals were used.

After the inspection, the company sat down to luncheon, which consisted almost entirely of Australian fresh meats which had been brought over in the Strathleven. The *menu* comprised lamb cutlets, beef olives, stewed chops and asparagus, minced collops, roast beef, mutton, and lamb, boiled mutton, and corned beef.

The Premier of Queensland (Mr. T. McIlwraith), said it was the immense undeveloped resources of that colony which prompted the chairman to try the experiment of which the success had been proved that day. About £5 per head had been paid for the bullocks, which would have cost £28 or £30 per head in England. He referred to the immense capabilities of New South Wales and Queensland for producing meat, and expressed the belief that in the future a great trade would be developed. They could produce meat and sell it at a profit of 2*d.* per lb., and he had no doubt it could be placed before the British public for 4*d.* per lb.

Mr. A McIlwraith, in responding to the toast of his health, said that the meat was purchased at about 1½*d.* per lb., and was expected to realize 6*d.* to 7*d.* in Smithfield Market. He hoped that in a short time he would be able to collect such information as would show that this meat could be imported on a much larger scale. If they could bring from 100 to 150 tons per week to England, it would relieve the surplus produce of the Australian colonies. Mr. T. McIlwraith next gave the health of Mr. James Campbell, C.E., who, he said, had really carried out the details of the experiment.

Mr. Campbell said that although fears were entertained for the success of the enterprise before they reached the tropics, no difficulty was experienced in passing through those regions, and he should have had no fears for the success of the experiment, even if a temperature had been experienced of 90°.

American Watches.

The American Watch Company, of Waltham, Mass., has lately received an order from the British Government for 372 watches, intended for the use of conductors, engineers, station masters, and other employés of the state railroads of India. This is the third large order received by the company from the same source, and, like the former ones, was obtained in public competition with foreign manufacturers. The London *Jeweler and Metalworker*, in its issue of January 15, observes, in reference to this order:

The contract for watches to be used by the officials on the Indian state railways has again been secured by the American Watch Company. This is the third time Messrs. Robbins & Appleton have received this distinction, which is not a barren one, for it must be evident to the most prejudiced individual that the timekeepers supplied on the previous occasions must have given satisfaction, and answered the tests required of them. This is a mortifying fact for Englishmen, especially for those who believe that were manufacturers here to show more enterprise, they would be able to compete advantageously in the manufacture of all grades of watches. —*Boston Advertiser.*

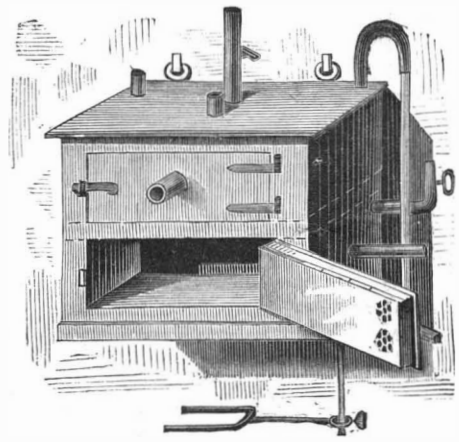
Light in the Home.

The eminent English writer, Dr. Richardson, produces in one of our contemporaries, an article called "Health at Home," which is replete with wisdom. A most important point, and one on which he dwells, is the fact that so many people are afraid of the light. "In a dark and gloomy house you never can see the dirt that pollutes it. Dirt accumulates on dirt, and the mind soon learns to apologize for this condition because the gloom conceals it." Accordingly, when a house is dark and dingy, the air becomes impure, not only on account of the absence of light, but from the impurities which are accumulated. Now, as Dr. Richardson cleverly puts it, we place flowers in our windows that they may have the light. If this be the case, why should we deprive ourselves of the sunshine and expect to gain health and vigor? Light, and plenty of it, is not only a purifier of things inanimate, but it absolutely stimulates our brains. It is in regard to sick rooms that this excellent authority is particularly impressive. It used to be the habit of physicians in old times to sedulously darken the rooms, and this practice continues to some extent even to-day. In certain very acute cases of nervous diseases, where light, the least ray of it, disturbs in over exciting the visual organs, this darkening of the room may be permitted, but ordinarily to keep light out of the room is to deprive the patient of one of the vital forces. Children or old people condemned to live in darkness are pale and wan, exactly like those plants which, deprived of light, grow white. Darkness in the daytime undoubtedly makes the blood flow less strongly and checks the beating of the heart, and these conditions are precisely such as bring constitutional suffering and disease. The suppression of the light of day actually increases those contagious maladies which feed on uncleanliness. Dr. Richardson states: "I once found by experiment that certain organic poisons, analogous to the poisons which propagate these diseases, are rendered innocuous by exposure to light."

DRYING OVEN WITH CONSTANT DRAUGHT OF DRY AIR.

Dr. Hermann Rohrbeck has devised some improvement in the usual drying ovens, whereby the complete drying of bulky precipitates at a constant temperature may be accomplished much more rapidly than usual.

The drying oven consists of a double walled square box, one side of which is provided with a door, or, as shown in the cut, with several doors. The upper surface shows three tubes, one of which communicates with the interior of the walls, and is intended for filling in water or other liquids, according as a higher or lower temperature is desired; the second (short) central tube communicates with the interior and is intended to receive a thermometer. The third (longer) tube, which is provided with a damper, is intended to regulate the draught and to allow the moist air to escape. The door or doors are also constructed with double walls, which are, however, not filled with water, but with fused calcium chloride. In the center of each door a tube, also containing a damper, is soldered upon the outer surface, by which the air enters the interior of the door walls, where it loses its moisture while passing over the calcium chloride, and it enters the interior by way of the star-shaped perforations in the inner surface of the door (see cut). In this manner the substance, which it is desired to dry, is constantly supplied with a current of warm dry air, and exsiccation proceeds quite rapidly. If a temperature of 100° C., or thereabouts, is to be maintained for a long time, an upright condenser may be connected with the tubulure through which the steam escapes, so that the water may be preserved at the same height. The apparatus is also provided with a water gauge, a faucet near the bottom for drawing off the water, and, if of the kind shown in the cut, with a double-walled diaphragm, through which the water likewise circulates.



ROHRBECK'S DRYING OVEN.

As the joints are hard soldered, the water may be replaced by higher boiling substances, such as anilin, paraffin, etc., without injury to the apparatus. The oven may either be placed on a stand, or it may be suspended on the wall, as shown in the cut.

RECENT INVENTIONS.

An improvement in pantaloons pockets has been patented by Mr. Morris Shrier, of New York city. The object of this invention is to provide pantaloons with two separate and distinct side pockets under the same outside pocket flat, so arranged that one can be entered from the side and the other from the top.

An improved ticket holder has been patented by Mr. Samuel Herzberg, of Pontiac, Ill. It is designed for holding the tickets on which are marked the sizes and other particulars of goods, such as pantaloons and other clothing.

Mr. John Hill, of Columbus, Ga., has patented an improved feed indicator for cotton openers. This relates to a convenient and certain means for determining the quantity of cotton to be fed to cotton openers, which serve to tear up and loosen the tussocks of cotton as they come from the bale, and distribute the fiber in the form of a fleece. In using these openers, two are sometimes employed together to act successively upon the cotton; or one opener may be employed in connection with a lapping machine, the function of which latter is to press together and compact into a fleece. In either case a hollow trunk has been employed as a conduit, in connection with a blast of air passing through the same, to act as a vehicle to carry the fleece from one opener to the other, or from the opener to the lapping machine, which second machine is generally located upon a different floor, or at a point more or less remote from the first. The invention consists in making the boxes of the upper feed roll of the second opener or lapper vertically adjustable, and connecting them with an index hand within sight of the operator at the first machine, so that the operator, at a point remote from the second machine, can tell the amount of cotton fed to the second machine by the rise or fall of the movable roller due to the passage of a greater or less quantity of cotton to the second machine.

Mr. T. O. Memery, of Key West, Fla., has patented an improved hinge for awning blinds, which is easily applied, and is not more complicated than the ordinary blind hinge.

An improved stock car has been patented by Mr. Sanford Bray, of Charlestown, Mass. The object of this invention is to furnish cattle cars so constructed that the cattle will be arranged compactly, and can be conveniently loaded and unloaded.

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AMERICAN INDUSTRIES.—No. 35.

THE MANUFACTURE OF SEWING MACHINES.

On the first page of this paper we present three views illustrative of the machinery used, and the methods of manufacture, in the factory of the Weed Sewing Machine Company, at Hartford, Conn., a firm which has for some time past taken a front rank in bringing the sewing machine to its present high state, and whose endeavors have been rewarded by a flattering degree of success, whether this be measured by the encomiums of those who are most expert in the business or by the rapidly increasing patronage of the public. In the engravings, the blacksmith shop represents what may, perhaps, be considered the commencement of the making of the working parts of the machine, and here are a number of drop forges in which these are struck out, homogeneous steel being principally used. Nearly every important piece of the machine, except the cast iron frame, is made by these forges, the exact pattern being first cut in the toughest steel. These dies are necessarily very costly in the first instance, but parts so made are always interchangeable; they make of each piece a thousand or more at a time, and every one stamped out must be a counterpart of every other one.

From this department the parts go to the machine room, shown in the large view at the top of the page, for milling, grinding, drilling, and a multitude of other finishing operations, and here also the cast iron work is finished. This room is filled with a great variety of costly machines, several of which would require considerable space to fully describe, but the ruling idea here, as in every other division of the business, is to have a perfect machine for each particular portion of the work. No part is so small but the most complete machinery is provided in order to make it just right, in the shortest time, and to insure the production of hundreds and thousands of the same part so they will be exact duplicates of the first one made. The shuttle, for instance, goes through thirty-four distinct operations, from the time it is cut from solid half inch bar steel until it is completed; all of these operations, with the machinery employed therein, were subjects of careful study and experiment, before the details of the work touching the production of shuttles were satisfactorily arranged. When this point is reached, however—and it is in a similar way that the work is carried on with reference to every other piece in the working part of the machine—then the manufacture proceeds like clock work, and the greatest exactitude and highest finish are regularly obtained.

In the "assembling" room, as its name indicates, the parts are put together, having previously gone through a testing room, where each separate piece is inspected and gauged, the defective ones being sent back to the machine room. As the machines are put together they are, at different times, placed upon "jacks" or frames driven by steam power at a high rate of speed, and run for some time, to insure that all of the parts are properly adjusted. From this room they are taken to another apartment, and again inspected piece by piece in their completed shape; after which each machine is sampled on various thicknesses of cloth, and with fine and coarse threads.

The japanning, or putting on the hard, polished black finish of the cast iron work, has a special department. The japan is put on with a brush, three coats being given, the pieces after each coat being baked for twelve hours, at a temperature of 360 degrees. After this process, and before the varnishing, the bronze and silver ornaments and fancy designs in colors are put on. This was formerly done with a brush, and anything as elaborate as the decorative work now put on machines would have been very expensive, but within the past two years the decalcomanie or transfer process has been generally adopted, and by this means the most profuse ornamentation can be quickly put on at a moderate cost. When this has been done, the varnishing is next in order, after which is another baking of twelve hours at a heat of about 160 degrees.

While it is not our purpose in this description to institute a comparison of the merits of the Weed machine with those of others in the market, it is not out of place to call attention to the special features to which the company principally attribute the deserved popularity of their machines. Four styles of machines are made, the "People's Favorite," the "Family Favorite," and two styles of the "General Favorite," the first-named being the lowest priced, while the latter are more especially intended for manufacturers, tailors, shoemakers, etc. All of these are alike distinguished for their simplicity of construction and perfect balance of parts, which renders them very unlikely to get out of order and reduces to a minimum the expense of repairs. The company claim that the latter class of machine is capable of being run at the rate of 800 stitches to the minute on leather work, and 1,250 stitches a minute on cloth, but in a New York factory the "General Favorite" is run on calf-skin uppers for men's shoes at a considerably higher speed than the company claim. All the machines make an elastic lock stitch, the loop being formed in the center of the material; the "feed" is either drop or wheel feed, as customers desire, and the tension can be so easily regulated as to afford some of the advantages of an automatic tension. A special merit is also claimed for the superior work which this machine will do in the use of cotton or linen where silk had heretofore been employed—a point in regard to which manufacturers have experienced no little difficulty, as cotton, with what is called a "silk finish," where the stitches can be seen, is now used to a great extent in place of silk.

The Weed Company have been manufacturing sewing machines since 1866. They were the first to apply to this manufacture the principle of interchangeability of parts, and at an early day began to use forgings to a very large extent in place of cast or malleable iron. In all their sewing machines steel and forgings are used wherever possible, great care being taken that adjoining working surfaces be of metals of different nature, thereby causing least wear from friction, and provision being made for the taking up of lost motion wherever such may occur from long continued strain. Direct crank movements are the main principles of these machines, gears, springs, and cams being eliminated, thereby securing positive yet easy action. The shuttles used in the Family Favorite and General Favorite machines are alike, carrying over fifty yards of coarse thread, having only one hole through which to pass the thread. The automatic bobbin winder, shown in Fig 2, is an especial feature of the Family Favorite machine, represented by Fig. 3, being patented and applied solely to it. Smoothly and evenly filled bobbins are a necessity for nice stitching, and this simple contrivance secures this end without trouble to the operator. All the modern improvements, such as "loose flywheel," "casters in stand," "rubber socketed hinges," "adjustable balance wheel shaft," "needle sockets," "self-acting tensions," etc., are incorporated in this machine, while, of course, the never ending variety of attachments are as applicable to it as any other.

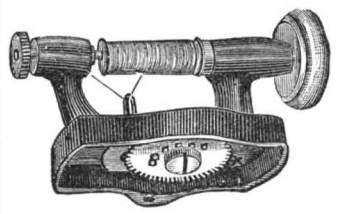

Fig. 2.—Automatic Bobbin Winder.

The works of the Weed Sewing Machine Company cover two acres of ground, and besides manufacturing the sewing machine, they make bicycles and an extensive line of fine steel and iron forgings for agricultural implements and steam machinery; also a number of other sewing machines for companies not having works of their own, among which is the McKay Twin Needle Machine, to the application of the principles of which the Weed General Favorite machine was especially suited. The power required is supplied by a 250 horse power engine, and the capacity of the factory is equal to the production of 250 machines a day.

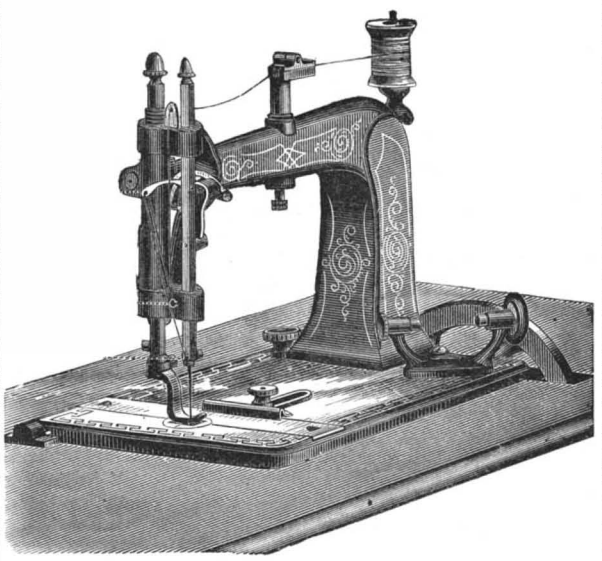

Fig. 3.—Family Favorite.

THE BICYCLE MANUFACTURE,

which is an important branch of business carried on at the Weed factory, is illustrated in the view at the bottom of the first page, in which are shown some of the final processes in the manufacture; on the left hand will be seen "forks," "backbones," "wheels," etc., in various stages of progress, and rows of completed machines awaiting shipment. The Weed Company are the sole manufacturers of bicycles for the Pope Manufacturing Company, of Boston, who control the patents for the United States on this specialty, and during the past year the demand for their "Columbia" machine has largely increased.

Although bicycles have been very popular in England for some time past, over 250,000 of them having been made there during the last few years, their adoption in this country has not been so general.

They differ in many points from the velocipede, the drive wheel being much larger, and the rider sitting almost vertically over the center of the wheel. It has been demonstrated that about as good "time" can be made with them as can be reached by the fastest trotters, taking only a mile or two at a time, while for long distances a good bicyclist will cover the ground in even quicker time than a horse can make. These "machine horses" have of late been coming into considerable favor, especially in Massachusetts and in the vicinity of Boston; such exercise is recommended by physicians, and, when one has acquired sufficient dexterity to be able to ride with facility, they afford the means, where the roads are open and good, of taking a kind of recreation which now promises to become more generally popular.

The great point in the manufacture of bicycles is to secure the maximum of strength with the minimum of weight, and the bicycle, as now made, is a splendid specimen of American workmanship. We say "American," because our mechanics have brought it to its present state of perfection; in England it is made in a number of factories, where most of the work is done by hand, and no one establishment has taken hold of the work in earnest, as is now being done at the factory of the Weed Sewing Machine Company. Here the same thorough and costly preparation as has marked their perfecting of the machinery for the manufacture of sewing machines is now evinced in their bicycle manufacturing department. The hub of the bicycle is forged in one piece of homogeneous steel, case-hardened, as are also the cranks and yoke, with dies made after patterns which embrace all the latest improvements. The steering head is a solid forging, and the backbone, as the tube is called, which extends from the yoke to the small wheel in the rear, is of steel, brazed to the head. The seat rests on a spring attached to this backbone, the spring being held by a sliding clasp. Wire of 12½ gauge is used for the spokes, which are headed in the fellies and then tightened in a socket at the hub by a nut. It is a work of considerable nicety to put a machine together, after all the parts are ready, so each spoke will be true and have its proper bearing; but they are tested as to how they will "track" until the variation is below one-sixteenth of an inch. The fellies are either V shaped or half round, and the tire is solid rubber, round, made especially for this purpose, and cemented in its place. The different sizes made range from 36 to 60 inches for the diameter of the large wheel, and the weight will vary from 40 to 55 pounds. There is, of course, a wide range of prices, which vary with the size of the machine, and the finish, there being three different styles made, known as the "special," the "standard," and the "ordinary," varying in material and design to suit the public tastes, from the heavy roadster to the light and trim racer, with ball bearings and all the latest devices to avoid friction and secure speed, strength, and lightness. The "Columbia" standard is a practically serviceable machine, especially suited to the wear and tear of ordinary American roads. In the construction of the higher priced machines nothing but steel and the finest forgings are used, to insure the greatest strength and rigidity with the least weight and most graceful shape. The company have thus far made about 1,200 bicycles, but now have orders on hand for 2,500, and they expect to be able to turn out 500 a month.

Although no "records" have been made in bicycling here to compare with what has been done in England, there have been many cases reported in which quick time has been accomplished for both long and short distances. One instance is given where forty miles were made in 3 hours and 36 minutes, and another where 100 miles were made in 11 hours and 45 minutes, including stops, the riding time being 10 hours and 15 minutes. In England, however, single miles have been made in a little less than three minutes, and from that up to thirty miles at a speed greater than a mile *each four minutes;* 212 miles have been made in less than 24 hours, and at Agricultural Hall, London, in April, 1879, 1,170 miles were made in six days. The difficulties of learning to ride a bicycle are said to be not as great as learning to ride horseback, or to skate or swim, and the healthfulness of the exercise, with the advantages which so simple and efficient a means for rapid locomotion offers to those so situated that they can avail themselves of it, would seem to give promise of its steadily increasing popularity.

Velocity of Rifle Balls.

Prof. Spice recently measured, before a large audience, the velocity of a rifle ball fired across the stage. The distance was only 33 feet. Lieutenant Merriam co-operated, and his duty was to shoot away, with a Creedmoor rifle, two loose wires, each of which connected in an electric circuit two globules of mercury. One wire was placed just in front of the supported muzzle of the rifle, the other 33 feet distant. Two levers were arranged, with bent wire points, over a piece of smoked glass to which a uniform motion could be imparted, and the electric connections were such that on the first wire being broken the point of the corresponding lever descended on the glass; but when the bullet broke the second wire it immediately rose again by the action of a spring. The result of this was that the point connected with this lever scraped a very short line on the smoked glass. The other point, being kept down during the swing of a seconds pendulum, scraped a longer space. After firing, the glass was withdrawn, and a magnified image of the lines thrown on a screen. The relative lengths of these lines were then ascertained, the longer being found 110 inches, the shorter 5 inches, making the duration of flight of the ball 5-110ths or 1-22d of a second, its velocity being $33 \times 22 = 726$ feet per second, or at the rate of a little under 500 miles per hour.

THE unreasonableness of mankind in general is pretty truthfully illustrated in the following item from the *Builder and Woodworker:* "When a man's house is building, he never thinks the carpenter puts in one-third enough nails, and frequently, and with biting sarcasm, asks him if he doesn't think the house would stand if he just simply leaned it up against itself and saved all his nails? Then, a few years afterward, when he tears down his summer kitchen to build a new one, he growls and scolds, and sarcastically wonders why that fellow didn't make the house entirely of nails, and just put in enough lumber to hold the nails together."

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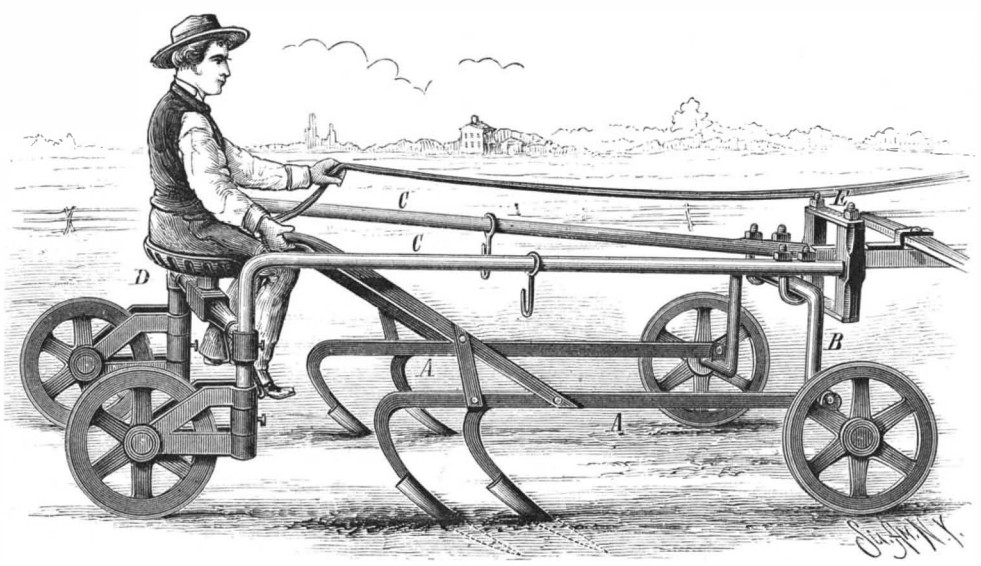
IMPROVED RIDING ATTACHMENT FOR CULTIVATORS.

We give herewith an engraving of a new riding attachment for cultivators, recently patented by Mr. Henry Cole, of Cedar Hill, Ohio. It is constructed so that it may be applied to any of the cultivators now in use, and will enable the driver, while riding, to guide the plows without great exertion, and permits of full control of the shovels. It is light on the horses, and may be turned in growing corn without breaking it down. The beams, A, of the cultivator have plows and handles attached in the usual way, and their forward ends are supported by the bent axle, B. To this axle two bent bars, C, are attached by a head, E. These bars are supported at their rear ends by caster wheels, and are connected by a cross bar, D, which supports the driver's seat. The tongue by which the attachment and cultivator are guided and drawn forward passes through the head, E, is jointed to the bars, A, and has the same movement as a common wagon tongue.

The advantages of this device will be understood and appreciated by those who have used the common cultivator.

The inventor may be addressed for further particulars.



CLOE'S RIDING ATTACHMENT FOR CULTIVATORS.

New Electric Lamp.

According to our English contemporaries, Mr. J. W. Swan, of Newcastle-on-Tyne, patentee for the carbon process of photography, has taken out a patent for improvements in electric lamps. It is stated that Mr. Swan has succeeded in making a lamp which gives a perfectly steady light, and is indefinitely durable. The light is produced by the incandescence of carbon, and ranges in power from one to ten gas burners. It is described as a moderate and pleasant light. It is claimed, on behalf of Mr. Swan, that many years ago he used carbonized cardboard, the feature in the Edison light.

We hope it may prove true that a lamp has been invented which will render the electric light a steady one, and we have no objection to Mr. Shaw being the fortunate discoverer of it. But this flickering difficulty has been so often overcome, according to the newspapers, both at home and abroad, that we have some doubts if the anti-flickering lamp has been found yet.

Transmission of Motive Power by Electricity.

At Shaw's Water Chemical Works, Greenwich, a neighboring waterfall furnishes the power to drive a circular saw, a turning lathe, and a vertical boring machine. Two Siemens machines and a water turbine are employed. The turbine is driven by the fall, and one machine is driven by the turbine. The current from the latter is conveyed to a second machine in the workshop 150 yards distant, and keeps the latter going. From this machine the tools above mentioned are driven by means of belting.—*Electrician.*

NON-CONDUCTING COVERING FOR HEATED SURFACES.

To secure the highest economy in the use of steam or in the use of heating or cooling agents, it is absolutely necessary to protect generators, pipes, and all other needlessly exposed radiating surfaces, with a non-conducting covering to prevent loss of heat by radiation or convection. The essential features of such a covering are, primarily, a low heat-conducting power and facility of adaptation to different surfaces, but in addition to these requisites it must be light, incombustible, and easily applied or removed.

There are numerous substances that will fulfill one or two of these requirements, but a perfect covering should embody all of the features enumerated. It is unnecessary to point out, except in a general way, the imperfection of many of the coverings now in use. Mineral substances, as a class, are fairly good conductors of heat, and are not, therefore, well adapted to the purpose. Hair and wool are, in themselves, good non-conductors of heat, but in the coarse felted form in which they are usually applied, these natural good qualities are not utilized to the best advantage, and besides this heat exerts a destructive action on hair or wool, so that they, in time, become friable, rendering it unfit for reapplication. Wood, which is sometimes used, is liable to warp and crack, and thus destroy its efficiency.

The Burgess non-conductor—the application of which we illustrate on this page—combines the advantages of all other non-conducting coverings, and is inexpensive, easily applied, very light and strong, and not affected by changes of temperature. It is applicable to plain or curved surfaces, pipes, elbows, and valves. It may be readily sawed, cut, and fitted by unskilled persons, and should occasion require, it may be removed and replaced without injury.

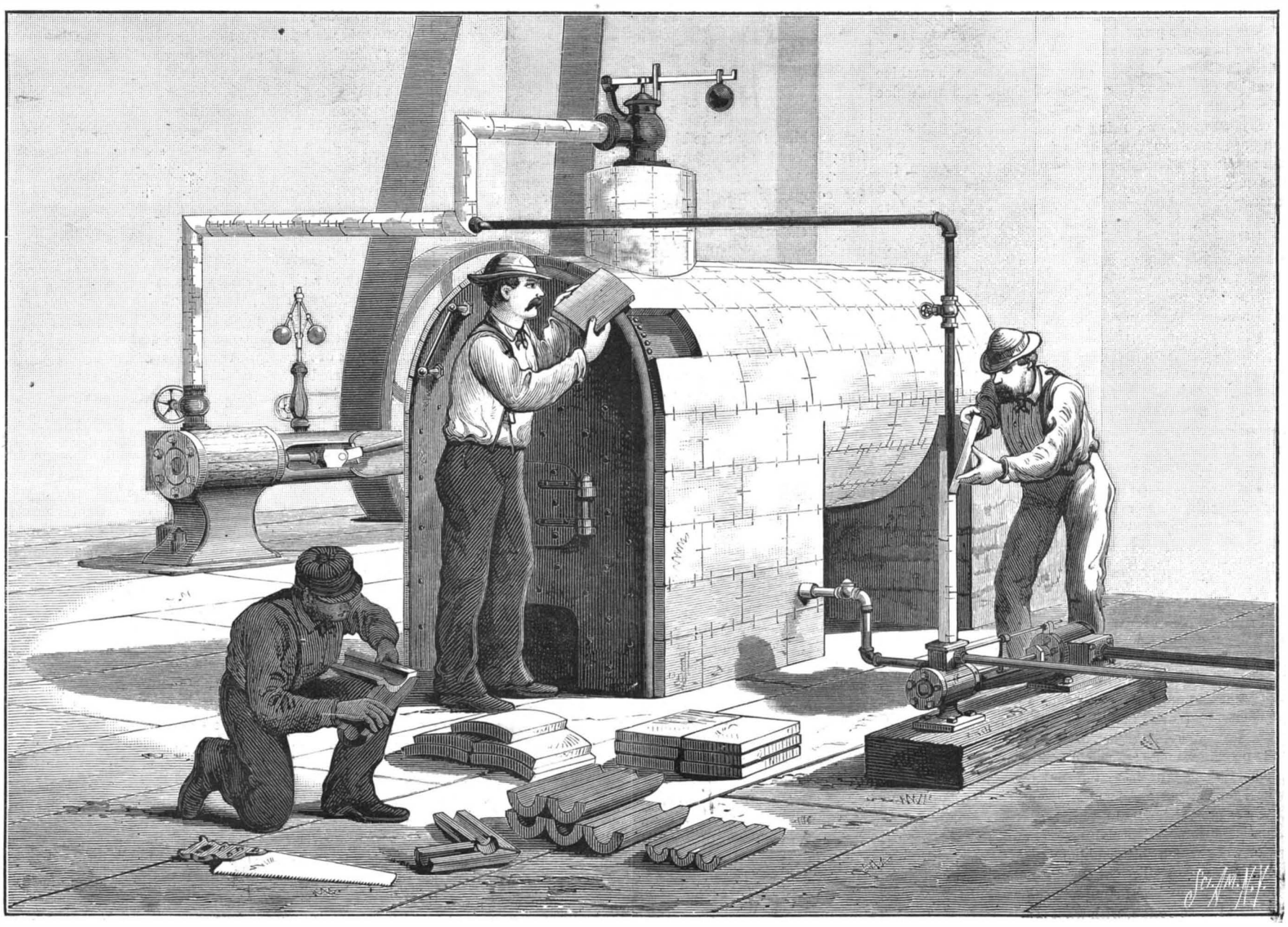
It is composed of vegetable fiber and sawdust, moulded into a light but firm body of sufficient compactness to prevent the permeation of heated air through it, while its porous texture insures that cellular structure most effective for non-conducting purposes. The covering is rendered incombustible by a peculiar process.

In applying the non-conductor to steam pipes, the end of one section is placed at the middle of the opposite section, so as to break joints, and the edges of the sections are pressed well together and secured by staples or by bands passing around the pipe-covering, which is afterwards covered with canvas. The sections may be mitered and adapted to elbows and bends by means of ordinary wood-working tools.

The machinery employed in making this covering is equally well adapted to mineral fiber, such as mineral wool or asbestos, and this company manufacture a special mineral covering for steam pipes conveying superheated steam.

We are informed that the great strength of this covering is due to the concentric arrangement of the fibers composing the sections.

Further particulars may be obtained by addressing the Burgess Steam Pipe Covering Company, N. W. corner Twentieth and Ridge avenue, Philadelphia, Pa.



BURGESS' NON-CONDUCTING COVERING FOR HEATED SURFACES.

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MEDUSÆ.

Discophora, a sub-class of hydrozoa, contains a number of free ocean swimming forms, mostly known as jelly fish, often growing to a very large size. In the first order (*Rhizostomida*) the tentacles hang down like a bundle of twigs from the under central portion of the umbrella-shaped mass, as is well seen in *Rhizostoma cuvierii*, a beautiful species often to be found in great numbers cast ashore on the south coasts of England and Ireland. In the second order (*Pelagiada*) the tentacles are placed all around the margin of the umbrella. The mouth is central. The accompanying figure will give some notion of these fragile forms. They are rarely solitary, but seem to wander about in considerable battalions in the latitudes to which they belong. During their journey they proceed forward with a course slightly oblique to the convex part of their body. If an obstacle arrests them, if any enemy touches them, the umbrella contracts and is diminished in volume, the tentacles are folded up, and the timid animal descends into the depths of the ocean.

In respect to size the species vary immensely. Some are very small, while others attain more than a yard in diameter. Many species are phosphorescent during the night.

Most of them produce an acute pain when they touch the human body. The painful sensation produced by this contact is so general in this group of animals, that until very recently all the animals of the group have been, after Cuvier, designated under the name of Acalephæ or sea nettles, in order to remind us that the sensation produced is analogous to that occasioned by contact with the stinging leaves of the nettle.

MEDUSÆ.

Bundles of Snakes.

The statements made by Humboldt as to the piles of snakes he saw in Guiana, can be verified here in our northern woods and swamps. I personally had the pleasure of observing it twice, both times very early in spring, and in locations which could be called wildernesses. I first saw such a bundle of snakes in the neighborhood of Ilchester, Howard county, Md., on the stony bank of the Patapsco river, heaped together on a rock and between big stones. It was a very warm and sunny location, where a human being would scarcely disturb them. I reasoned that the warmth and silence of that secluded place brought them together. Some hundreds of them could be counted, and all of them in a lively state of humor, hissing at me with threatening glances, with combined forces and with such a persistency that stones thrown upon them could not stop them nor alter the position of a single animal. They would make the proper movements and the stone would roll off. All the snakes in this lump were common snakes (*Eutænia sirtalis*, L.). The second time I noticed a ball of black snakes (*Bascanion constrictor*, L.) rolling slowly down a steep and stony hillside on the bank of the same river, but about two miles above Union Factory, Baltimore county, Md. Some of the snakes were of considerable length and thickness, and, as I noticed clearly, kept together by procreative impulses.

It is surely not agreeable to go near enough to such a wandering, living, and hissing hundred-headed ball to examine the doings and actions, and search for the inner causes of such a snake association. As, furthermore, the localities for such mass meetings of snakes are becoming rarer every year, and our rapidly increasing cultivation of the country must make it hotter for snakes everywhere, only a few naturalists could see such a sight, even if they should look for it in proper time, which, as stated above, seems to be the first warm days in spring.—*E. L., Ellicott Mills, Md.*—*American Naturalist.*

The Circulation of the Blood Made Visible.

Dr. C. Hüter, a German *savant*, of Greifswald, has devised a simple arrangement which demonstrates the circulation of the blood in the human body by making it visible. Dr. Hüter's method is as follows: The patient's head being fixed in a frame, on which is a contrivance for supporting a microscope and a lamp, his lower lip is drawn out and fixed on the stage of the microscope by means of clips, the inner surface being uppermost, and having a strong light thrown upon it by a condenser. When these preparations are completed all the observer has to do is to bring the microscope to bear on the surface of the lip, using a low power objective, and focusing a small superficial vessel. At once he sees the endless procession of the blood corpuscles through the minute capillaries, the colorless ones appearing like white specks dotting the red stream. Dr. Hüter asserts that by taking careful note of variations in the bloodflow and changes in the corpuscles he has derived great advantage in the treatment of medical cases. This is the first instance of the flow of the vital fluid in one person being watched by another.

An Odd Fish in the Far West.

A correspondent writing from Hutchinson, Kansas, to the St. Joseph, Mo., *Herald*, says: "This place is considerably excited over the finding of a fish with four legs and a frill or sort of a ruffle about its neck, in a well forty feet deep. This little curiosity is the same as that discovered by Professor O. C. Marsh, in 1868, at Lake Como, in Wyoming Territory, to which he gave the name of *Siredon lichnoides*. Out in that territory they are known as the "fish with legs," and are from five to ten inches in length. The one found at this place is about three inches in length, as a siredon enjoys the external branchial appendages or gills, making a partial frill to the neck, and membrane along the back and tail, resembling that of the tadpole. The head is like that of the yellow catfish, the body of a dark olive color, and partly transparent.

According to Professor Marsh's experience with the siredons, this little creature will undergo a change like the tadpole, and the beautiful ruffle about the neck and the tadpole-like membrane will be absorbed by the body, various other changes will follow, and the little wonder of Hutchinson will be transformed into a complete animal, formerly known as the *Amblystoma mavorlium*, and the doctrine will be proven that all siredons are merely larval salamanders.

Curious Mental Relations of Self-Consciousness.

What constitutes individuality or personality has long been one of the hardest nuts for metaphysicians to crack. There was a famous instance in the early part of the seventeenth century, on which both Descartes and Spinoza sharpened their wits. A Spanish nobleman received a blow on the head, from which he apparently recovered completely, but with total forgetfulness of everything and everybody that he knew previous to his injury. He was obliged to learn the language anew, and could not be brought into any mental relation with his former self, though in other ways quite sane. Spinoza does not hesitate to say that he was a different person than before, another individual.

His argument is subtle; in a modern version it may be stated thus: as we recognize personality to continue, although all the matter of which the body is composed changes every few years, or, as some say, every few months, the element of personality must rest in the continuity of psychical impressions; when this is absolutely dissevered, then personality ceases; otherwise, if we maintain that it does not, because the body remains, we are in the position of the man who claimed his knife was the same after he had got a new handle to the blade and a new blade to the handle!

Physiology comes to the aid of metaphysics by defining the sense of personality as one of the cerebral forces dependent on nervous action at once continuous and related. There are examples where it is continuous, but not related. A famous example occurred in the Franco-German war. A soldier wounded in the head recovered with the odd sequel of a double mental life; for several weeks he would live one life, then pass into another, with no recollection of the former one, but with its own independent series of acquisitions and impressions; then he would revert to his first life again without a shadow of memory of his intermediate existence, and so on alternately.

This duplicate existence is quite common in epileptics, and the clinical records of that malady offer a number of carefully recorded cases. In a less degree it may be said to be the case in dreams. It is explainable on the supposition that certain portions of the brain are active at one time, dormant at another; or that during one period one half of the brain is at work while the other half is not; and that when this condition is reversed, total forgetfulness of the intervening period ensues.

Several recent cases have been recorded in the medical journals analogous to those we have referred to. In one, a man of about fifty years, with some money, well dressed, and with a traveling bag, found himself in a small city in Ohio, without any knowledge of who he himself was, whither he was going, or whence he was from. On other subjects he was perfectly sane, proving quick at figures and an expert penman, of good education and polished manners, altogether a competent man of business, except this one extraordinary and remarkable trick of memory. What is unusual and a little suspicious was the fact that nowhere about him was any old letter, note book, mark on his linen or clothing anywhere, which bore a name, initials, or monogram. It looked as if he had prepared himself to lose himself. It were well, if this thing grows common, for every prudent man to have a line in his pocketbook to this effect: "Mem.: I am John Smith, of Smithville," so that when he forgets who he is, he can remind himself of the fact.

In one of the recent numbers of *Lippincott's Magazine* is a case, probably an imaginary one, but quite consistent with facts, where a man believes he has lived two distinct lives, remembering each with equal certainty; one as a well-to-do lawyer, the other as a needy New England farmer. As he was in truth the latter, the "remembering happier things" was constantly to him, as the poet says, "a sorrow's crown of sorrows." In certain forms of progressive paralysis, the "*delire des grandeurs*," an analogous condition, is witnessed. The confident belief expressed, and no doubt entertained, by Mahomet, Swedenborg, and other mystics, that a large part of their lives was spent in heaven, or in delightful converse with heavenly visitors, is a closely allied delusion. The common mental trick of almost unconsciously doing an

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action or keeping up a formal conversation while the intellect is delighting itself in wholly remote fields of thought or imagination, so beautifully described in Xavier de Maistre's "Voyage autour de ma Chambre," under the figures of *le bête et l'ame*, illustrates how closely the ordinary processes of the mind may parallel these extraordinary vagaries.—*Medical and Surgical Reporter.*

MISCELLANEOUS INVENTIONS.

An improvement in oil cans has been patented by Mr. Jacob Rhule, Jr., of Pittsburg, Pa. The object of this invention is to provide a safe and convenient receptacle for oil; and it consists in providing an oil can with a stopper which, if the can be accidentally overturned, will not allow the oil to escape.

Mr. William Huey, of Cambridge, Md., has patented an improved means for transporting eggs and other fragile or perishable articles. It consists, first, in a case formed with parallel partitions subdivided into cells for the eggs by elastic wings secured flexibly upon one side to the parallel partitions, and overlapping at their free ends to form expansible cells or pockets to receive and protect the eggs.

Mr. William A. Galbraith, of Flint, Mich., has patented an improvement in that class of carriage poles that are capable of being adjusted and readily fitted to vehicles of any width, the object being to decrease the weight of the poles and make them more durable and effective in their operations.

Mr. James W. Hammett, of Willow Island, West Virginia, has patented a simple and effective apparatus for making wells. It consists of several distinct parts or tools that must co-operate to effect the purpose aimed at. The invention cannot be clearly described without engravings.

Mr. Louis M. Candidus, of Brooklyn, E. D., N. Y., has patented an improved apparatus for curing leaf-tobacco by means of steam without contact between the steam and tobacco, and at the same time carry off the vapors expelled from the tobacco.

Mr. James B. Parker, of Memphis, Ala., has patented an improved cotton picker, which consists in combining with a suitable framework and driving mechanism improved devices for picking the cotton from the bolls, for removing the fiber from the pickers, and for carrying off the collected fiber.

Mr. William W. Bolles, of Toledo, O., has patented an adjustable ornamental window cornice that without alteration can be adjusted to a window of any width. The invention consists of an ornamental piece of moulding, on which are secured thicker and grooved or channeled edges, and on each end of which is rigidly fixed a mortised truss, the whole forming the center piece of the cornice. The side extensions of the cornice consists of two pieces of moulding that are made to slide in the mortises of the trusses and the channels or grooves of the edge strips, and meet behind the center piece. The mortises in the trusses conform in their general outlines with the outlines of the mouldings, and the trusses are also cut through from their tops to the mortises, in order to make them so elastic that they will not bind on the sliding cornice extensions.

Mr. William C. Doddridge, of New Madrid, Mo., has patented an improved heating device of the kind forming an attachment or appendage of a stove or furnace pipe, and commonly employed as a substitue for a stove or grate in apartments contiguous to that in which is situated the stove or furnace with which such pipe connects.

Mr. Charles Rosencrans, of Philadelphia, Pa., has patented an improved box loop for harness saddles provided with transverse ribs which keep the leather covering in its place, and also protect it from abrasion and wear, and having a solid flat bottom with centrally projecting lugs.

Steam Pressure and Temperature.

The temperature of steam developed from water by boiling will be in an unconfined state 212°. This temperature is increased by putting a pressure on the steam, *i. e.*, by confining in a closed vessel, provided with a safety valve to work at a certain pressure. The following will give an idea of the ratio in which the temperature rises in steam under pressure:

Pressure.	Temperature, Fahr.	Increase of Temperature.
1 lb.	214°	
100 lb.	338°	124° first 100
200 lb.	388°	50° second 100
300 lb.	422°	34° third 100
400 lb.	448°	26° fourth 100

Natural Lime.

To the Editor of the Scientific American:

In Vol. xlii., No. 2 (new series), SCIENTIFIC AMERICAN, January 10, 1880, page 25, a correspondent of the *American Architect* is quoted, giving a lucid account of "Kansas Natural Lime." He closes with the inquiry, "Does such a strange product as this occur in any other section of our continent?"

I answer, yes. From 1870 to 1874 I was United States Consul at Paso del Norte, Mexico. And, while prospecting for silver ore, I discovered a large deposit, in what miners term pocket formation, of natural lime, located in blue limestone, in the foot hills, one and one-half miles west from the city of Paso del Norte, Mexico. I gave it various trials, and found it to possess all the good qualities of manufactured lime, and for whitewashing far superior to the manufactured article.

WM. M. PIERSON.

Fort Bayard, Grant County, New Mexico, Jan., 1880.

New Transit Instrument.

At a recent meeting of the Massachusetts Institute of Technology, at Boston, Mr. S. C. Chandler exhibited and explained a new astronomical instrument designed by himself, for the determination of time and latitude. It is, in brief, a self-adjusting transit instrument. Instead of depending upon the ordinary means of accuracy, such as nicety in fitting the pivots, setting and observation of spirit levels, and other parts, the new instrument is made to float on mercury, and thus level and adjust itself. The instrument was explained as follows by the inventor:

It consists of a base of walnut, with approximate leveling screws at the four corners. From the middle of this base rises a pillar of black walnut firmly bolted to the base and surrounded by collars of hard brass. An outside sleeve of hard brass which turns on these collars supports the remainder of the instrument; this sleeve being rotated in azimuth by a rack and pinion movement, and provided at its base with a graduated setting circle. On top of this sleeve is a wooden crosshead, which supports a wooden trough in the form of a hollow rectangle, and in this trough is placed mercury to a depth of one-eighth of an inch. The trough is constructed of wood instead of brass, because the mercury would attack brass. Whether it would be better to use cast iron is an open question.

In this trough, on the mercury, there floats a wooden float, also in the form of a hollow rectangle, and nearly as large as the inside of the trough, this float being held in position at the middle of the two sides by two cast iron pins, which move in vertical slots in the sides of the float, and which are sufficiently loose not to interfere with its floating freely, but which serve to prevent any violent or sudden motion.

The above mentioned float has attached to it two brass arms, which support the telescope, the latter projecting through the hollows of the hollow rectangles of the float and trough.

The trough is not supported in the middle, but nearer one end, in order to allow of zenith observations; and on this account a counterpoise is attached at the other end of the trough.

The attempt has also been made to so proportion the parts as to bring the center of gravity of the floating part as near the axis of oscillation of the telescope as possible, in order to reduce oscillations due to jars, etc.

The illumination is effected by a series of reflectors, and comes from the side. The cross hairs are horizontal, and not vertical, as in the transit. The reason for this will be explained later. In using the instrument the telescope is set at a certain inclination to the vertical, and as the instrument is rotated in azimuth, the line of sight sweeps out a horizontal small circle of the heavens, *i. e.*, a circle of which the zenith is the pole.

For the determination of the zenith, the free upper surface of a liquid is used, and we have dispensed with the error of pivots, the error of level, and the error of azimuth, and have left only what is, in a certain sense, analogous to the error of collimation in a transit instrument, the characteristic of both errors being that the telescope describes a small circle, parallel, but very close, to the circle in which it is intended to revolve. The amount of this deviation in this instrument is not, however, determined by reversals of the telescope, as in the case of the transit, but by observation of the stars, in a similar way to that by which the azimuth error of the transit is found. As to the disturbance of the instrument by oscillations, the most violent oscillations I have been able to produce have required thirty seconds to have their effect dissipated, and after this time has elapsed the instrument is as quiescent as though it were mounted on stone.

It is, of course, specially adapted for observing equal altitudes, and can also be used to observe the transit of stars across any desired small circle having the zenith for a pole, and hence the reason why the cross hairs are horizontal instead of vertical.

All observations are influenced by refraction, but refraction operates to elevate all the stars equally at the same time. Hence we can disregard the error of refraction in a series of observations taken so near each other that there is no probability that the coefficient of refraction of the air has changed, and we can simply account it as part of the instrumental error; it having the same coefficient, hence when the observations are reduced to middle time this error is almost wholly eliminated. Next, as to the results that can be obtained by this instrument, I have not yet been able to make a great many observations, but those that I have made encourage me to believe that when as good mounting is given to it as is given to an astronomical transit, better results can be obtained with it than with the latter. I have used it very roughly, making observations from the roof of my house, which was subjected to a constant jarring from the teaming in the street below, and where the instrument was exposed to the wind.

I have compared my results with those of larger coast survey transits, and mine are the best.

I have not yet determined all the constants of the instrument. I find that the wind does interfere with it somewhat when employed in the open air and unprotected, but the deflections from this cause are but momentary, and errors due to a draught would be nearly eliminated were a greater number of cross hairs used.

Next, as to latitude. The transit instrument, when placed in the meridian, is used only for time; it can be used for the determination of latitude if placed in the prime vertical. The Coast Survey have introduced for this purpose the zenith telescope, and have obtained with it the very best results. To compare my instrument with this is a very severe test; although I have had only three evenings on which I could make observations for latitude, the results obtained are remarkably good. The claims, therefore, that I make for my instrument are the following, viz:

1. The ability to use any part of the heavens that are not obscured by clouds. In using the transit it is often impossible to obtain observations when clouds hang in the meridian, even though there be any amount of clear sky on either side. With my instrument we can use any region of clear sky in the heavens, as we can use any horizontal circle whatever; although the use of the same circle all the time renders the computations easier.

2. There is only one instrumental error to determine, instead of four.

3. This instrument is unaffected by errors in mounting.

4. Simplicity in use; requiring no readings of level nor reversals. In the use of the transit about one-half the time is taken up by these processes, which are unnecessary with my instrument.

5. The construction is very cheap.

6. Combination of a time and latitude instrument in one.

7. It admits also of the application of a delicate micrometer on an entirely new principle, as a micrometer screw carrying a weight could be mounted on the float, thus enabling us to move the center of gravity of the floating part, and to tilt the axis of the telescope. We can thus apply here the same methods that we can in the zenith telescope.

The Atmosphere and Yellow Fever.

During the yellow fever epidemic of 1879, Mr. William Van Slootin, C.E., of New Orleans, made chemical analyses of the air from September 9 to November 24, and found, according to Dr. Clendinning, of Fort Lee, N. J., a series of extraordinary variations in the amount of free and albuminoid ammonia to the million of cubic feet of atmosphere. These corresponded very curiously with the progress and fluctuations of the epidemic. For instance, on September 9, the analysis showed 125·62 grains of free and 350·56 grains of albuminoid ammonia to each 1,000,000 of cubic feet of air. On September 19 the amount of albuminoid ammonia stood at the extraordinary figure of 400·75 grains. This was its highest point, and, with many fluctuations from day to day, it gradually declined as the epidemic wore out its fury, until on November 24 the amount was only 47·25 grains. The curve of the free ammonia was less regular, but the decline had a general correspondence with that of albuminoid, until on November 24 the amount had fallen to 23·31 grains. The amount of ozone showed a similar variation from half a grain per 100 cubic feet of air on September 18, to seven grains on October 22, from which it appeared that the increase of ozone was accompanied by a constant decrease of ammoniacal products. The fluctuation of both from day to day and week to week, as the wave of the epidemic rose and fell, was very striking.

Surveying by Photography.

This was the subject of a lecture lately delivered at the Plymouth Athenæum, by Mr. W. G. Tweedie. The lecturer proposes to use for the purposes of surveying a camera by which a cylindrical projection of the objects is taken on a flat plate. Two such photographs, taken from the extremities of a measured base line, will, he declares, supply all the necessary data for making a map of the whole of the country in front. From these two photographs, by means of two scales of simple construction, the surveyor's work hitherto done in the field will be equally well performed in the office, and by the use of dry plates, the operator is relieved from all chemical operations in the field. The plates can be bought ready prepared, and sent to the professional photographer to be developed. The lecturer exhibited several remarkable instantaneous photographs he had taken, and explained the nature of the camera used and the *modus operandi*. In the subsequent discussion, it was suggested that Mr. Tweedie should practically test his invention by surveying on his new method some of the ruined castles on the moor.

Electrotyping with Iron.

Herr Böttger describes a process for steeling copper plates by electrolysis. 100 parts of ferrous-ammonia sulphate, together with 50 parts of sal-ammoniac, are dissolved in 500 parts of pure water, a few drops of sulphuric acid being added to acidulate the solution. The copper plate is connected to the negative pole of a battery of two or three Bunsen elements, an iron plate of equal size being employed as an anode. The solution is maintained at from 60° to 80°. The deposit of iron is of a hard, steel-like quality, and is very rapidly formed.

Capsuling Bottles.

In France a new system of capsuling bottles has come into vogue which is more rapid than the use of metal capsules, and is thought, by some, to give a more elegant effect. The neck of the bottle is dipped into a viscous volatile liquid and immediately withdrawn with a rotary movement. This leaves a transparent capsule, the effect of which is improved by first attaching a monogram or trade mark to the top of the cork or upper end of the bottle neck. The following is the formula for the liquid: Yellow resin, 20 parts; ether, 40; collodion, 60; fuchsine, or other tint, *q. s.*

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Exhibition of Earthenware.

An International Exhibition of earthenware, chalk, cement, and gypsum industry is to be opened at Berlin from June 29 to August 10, 1880. The following are the rules for sending objects to the Exhibition:

1. Only such objects can be sent to the Exhibition as are directly or indirectly made of brick, tiles, earthenware, chalk, cement, or gypsum.

2. The committee has to decide about the named objects, and of the amount of space granted to the exhibitors.

3. Application must be made before the 15th of March, 1880, but it is most desirable to have the applications as early as possible, so that the space may be fixed, especially as there is the prospect of nearly all nations taking part in the Exhibition.

4. The forms of application are to be made in duplicate by each of the exhibitors, and to be sent to the president of the committee—Herrn Paul Loeff, Privat Baumeister, Berlin, S. W.

5. Should the object be admitted, a certificate of admittance will be made out on the information paper, which at the same time contains a declaration of the exhibitor. One of the application papers will be returned as a receipt. Only those exhibitors who possess a receipted form can be admitted to exhibit different objects.

6. All the admitted objects must be at their proper places (appointed by the committee) three days before the opening of the Exhibition, in perfect order and dry colors. The committee reserves the right of deciding about the unoccupied space, without being obliged to return the money. Other places than those given by the committee are not allowed to be used.

7. The committee will give a number to each object, before it is placed in the Exhibition building, which will correspond with the number in the Exhibition catalogue. This number must be fixed to each object, so that it can be seen for the whole time the Exhibition is open.

8. All exhibitors, their agents, or their workmen, must submit themselves to the committee, or to the officials of the Exhibition.

9. The committee does not undertake any responsibility in case of damage or loss of those objects which are brought to the Exhibition, but they will take the greatest care in watching the objects. Fire or light can only be used by specially written allowance from the committee.

10. The committee will undertake to arrange for the fire insurance if desired, but the expenses fall upon the exhibitors.

11. The price for space occupied is fifteen marks per square meter; unoccupied space will be eight marks the square meter. The minimum price for occupied space will be twenty marks, and for unoccupied space twelve marks per square meter.

12. The exhibitors must clear their objects immediately after the Exhibition is closed, but no object can be removed before the final closing.

13. An Exhibition agency, which will be put under the control of the committee, will carry out all commissions given by exhibitors for a small payment. The exhibitors have to take upon themselves the transport of the Exhibition objects, as well as unpacking, arranging, and repacking. The committee has made arrangements to have the work done by their agents at a small expense, in order that the exhibitors may be saved from overcharge, as has been the case at former Exhibitions. If desired by exhibitors, artisans and workmen can be provided for by the committee at the lowest rate.

14. No exhibitor is allowed to put an engine into motion before he has obtained special permission from the committee. This permission will be given on the fulfillment of the rules. The supply of the necessary material is to be arranged in each case with the committee.

15. If special architectural plans are desired, they have to be named under No. 9 in the forms of announcement; if necessary, designs should be added. At the wish of the exhibitors, the committee will undertake the erection of such engines as are required.

16. Those exhibitors who want special foundations must have them erected by the committee, and pay the necessary expenses.

17. Prizes will be given in each section, but a juror cannot be an exhibitor in his own section. The names of the jury will be published in the middle of July.

18. The Exhibition catalogue will contain advertisements, and each exhibitor can make use of the allotted space by paying 75 pfennings (or 9½*d.*) for a *petit* line.

19. The committee reserves the right of altering these rules, and retains the power of refusing such applications as are thought unsuitable.

20. Demand will be made for the return by the railway authorities, gratis, of all objects which are not sold, the result of which will be published in due time.

PAUL LOEFF,
The President of the Committee.

DURING the recent Applied Science Exhibition, Paris, a diploma of honor was awarded to Count de Beaufort by the Society for the Aid of the Mutilated Poor for the best display of artificial limbs. Among the exhibits was a carpenter who had artificial arms, but was to be seen daily working at his trade; also a girl in same condition who sat knitting, much to the satisfaction of the spectators.

American and English Hardware.

At a recent meeting of the Manchester Scientific and Mechanical Society, a paper on "American and English Hardware," was read by Mr. F. Smith. A circular paper was read last winter by Mr. Smith, when he spoke strongly of the apathy and the want of inventive and progressive spirit which seemed to characterize the English manufacturer. Since then a number of samples of builders' hardware had been sent to him by both American and English makers, and some of these he laid before the meeting.

After describing the various examples, in which he pointed out the superiority of the American over the English article, Mr. Smith said that as he had not a personal knowledge of the rules of the various trades unions in the lock districts, he was not prepared to assess the value of the statement made by some people to the effect that much of the inferiority of the English goods was to be attributed to the absurd and anti-progressive action of the unions. But he failed to see how they could be justly held responsible for inferior castings, bad japanning, and clumsy design. For a long time our manufacturers, having had command of both their own and foreign markets, had been masters of the situation, and the result had been, first, a laxity in the supervision of the processes of manufacture. So long as the article produced by the "garret master" brought profit to his principal, the clumsy, wasteful, "rule-of-thumb" process by which it was produced was not considered, and if the late depression had given our manufacturers time to think, they might say, "Sweet are the uses of adversity."

Secondly, this abundance of work, if he was rightly informed, had led in many cases to the buying up and suppressing of improvements; and, thirdly, this great demand had led manufacturers to lose sight of the quality of their goods, and to enter into competition with each other to produce a low-priced article. After condemning the pestilent fallacy which was often raised, "our customers demand these worthless goods," Mr. Smith said that if they wanted to get an idea of how our national prosperity was influenced by the quality of the goods we manufactured they had only to consider the position held by certain firms. Why should a Chubbs lock or a Whitworth lathe command higher prices than even the good work of less known firms? Simply because the name guaranteed the quality, and when the same could be said of English goods generally we should be in a fair way to "enjoy our own again."

Another and most important factor in the sum of dead weights under which we had to struggle was our absurd patent laws, and if our legislature had set out with the intention of suppressing the inventive genius of the country they could not have succeeded more completely than they had done.

In order that we might improve our goods it seemed to him that we must discard many of our old and obsolete patterns. We must adopt a method of founding which would secure a clean casting. We must copy the Americans in the employment of mechanicians and artists, one to arrange the mechanical portions of the work and the other to design suitable and artistic forms. We must look far more to our reputation for good and honest work, and we must agitate for such an alteration of our patent laws as would place it in the power of the skillful artisan to protect the fruits of his brains at a reasonable cost.

In conclusion, he believed that there was enterprise and skill sufficient among our workmen and manufacturers to enable us to recover much of our lost ground, and the samples of English goods which he had displayed that night showed a marked advance upon those of three or four years back, while the prices were low enough to secure a sale, although in some cases a better article could be produced at the same cost.

A discussion followed the reading of the paper.

The chairman observed that there had been great room for improvement in this branch of trade for the last twenty years, and Mr. Smith had attributed this want of improvement to the right cause. This class of goods had not been made by mechanical men. One manufacturer got into a certain groove, and they would have kept much longer in that groove had it not been for the competition of America. He had not the slightest doubt we could produce these articles quite as cheap and as good in England as in America. In the way of castings, America could not surpass us, and it was only necessary that our manufacturers should get out of the old groove, and introduce scientific and mechanical motions into their productions to enable us to outstrip America.

Mr. Corbett also thought one great fault had been that we had got too much into one groove.

Mr. McLeod was of opinion that the existence of store factories in every town was one reason why the Americans were able to turn out such good small castings.

Mr. Heys strongly condemned the want of intelligence displayed by English founders; there were one or two firms in England who could make good castings, but they were the exception. If we could only persuade our founders that they could improve on their existing processes we should have made a great step.

A LARGE HOG.—A hog measuring 9 feet in length, 7 feet 2 inches in girth, and weighing 1,137 pounds, dressed, has been on exhibition at the Continental Market, Broadway, near 32d street. Before killing, the animal weighed 1,390 pounds. It came from Copake, Columbia County, New York.

Recent Progress in Chemistry.

Professor Dewar, F.R.S., Jacksonian Professor in the University of Cambridge, England, lately commenced a course of eight lectures on "Recent Progress in Chemistry," at the Royal Institution, London, where he fills the chair of that science. In his first lecture he dealt with the advances in chemical theory made good by the two main lines of attack on the mysteries of chemical action. These were—first, the hypothesis that matter is constituted of molecules in motion, whose structure and action may be ascertained from the investigation of sensible masses of matter; and the other or modern method, which was based solely on the two fundamental laws of physical action, namely, the conservation of energy and its general tendency towards dissipation. Thus, chemical science, so long statical, had now an extensive dynamical literature, as an admirable example of which was mentioned the lately published work of Professor Berthelot, of Paris, entitled "Essai de Mécanique Chimique, fondée sur la Thermochimie."

The lecturer then proceeded to illustrate the great advance in our knowledge and in our power of manipulation of high temperatures, referring to the immense industrial advantages derived from the introduction of Siemens' regenerator into all chemical manufactures involving the necessity of using furnaces at white heat. He proceeded to show that the recent introduction of magneto-electric machines enabled chemists to examine the interaction of bodies at temperatures far above that of any flame, which never exceeded 3,000°. With this view he showed, for the first time in public, experiments of his own. As an instance may be given his raising a carbon tube inclosed in lime by means of the Siemens electric arc to so high a temperature that the intensely heated part of the tube became changed into graphite, and by passing a mixture of equal volumes of hydrogen and nitrogen through this tube be formed prussic (hydrocyanic) acid by the direct union of carbon, hydrogen, and nitrogen. He thus proved that this exceptional chemical combination is not brought about by any occult electrical effect caused during the transit of the electricity in the arc, but that it is the result of the exceptionally high temperature of the carbon in presence of the gases. The old doctrine of chemical affinity had, in fact, been so far modified as to accord with a mechanical definition, which might be thus formulated: That if two or more compound bodies are capable of reacting chemically to form new substances, then that substance will be formed which, *par excellence*, is attended with the greatest dissipation of energy—*i. e.*, with the greatest evolution of heat.

Further experimental illustrations were given of apparent anomalies in chemical decompositions brought about by the passage of electric currents through fluids. Thus it was publicly shown for the first time that acidulated water, which is readily decomposed into hydrogen and oxygen by the current of a single pair of voltaic cells, was yet seemingly quite unattacked by the passage of the powerful intermittent current of De Meritens' magneto machine, which has a power of, say, 50 cells of Grove's battery. This, it was explained, was due to the superposition of alternate layers of hydrogen and oxygen at the poles something like 300 times every second under the most favorable conditions for chemical recombination. The apparent absence of decomposition could only be explained by the constant interchange of decomposition and recomposition. This was demonstrated by the use of the telephone, which revealed a rapid intermittent current passing through the cell, and further by the continuous rise in temperature of the contents of the cell. The lecturer proceeded to deal with the allotropic modifications of bodies, which branch of the subject he proposes to continue in his next lecture.

Strikes in Massachusetts.

The Eleventh Annual Report of the Massachusetts Bureau of Statistics of Labor, recently presented to the State Senate, contains an account of all the strikes which have occurred during the past fifty years. The total number of strikes and lockouts included in this record is 159. Of these 35 occurred in Boston and its annexes, 14 in Lynn, 10 in Lowell, 9 in North Adams, 8 in Fall River, 4 each in Worcester, Chicopee, and Marlborough; 3 each in Taunton, Natick, and Blackstone, and the remainder scattering through 41 towns. The noticeable facts are brought out that 76 of these strikes were effected chiefly by workmen of foreign birth, and that of these 159 strikes 59 were among textile factory operatives, 34 in shoe factories, and 10 among builders, while the remainder were distributed in small numbers among 25 industries. More than two thirds of the strikes, 109, were unsuccessful. Only 18 are recorded as wholly successful, 6 as partly successful, 16 as compromised, and the result of 9 is unknown. In respect to the causes of strikes, 118 were to secure better wages, 24 to secure shorter days, 9 to enforce trades union rules, 5 to resist employers' rules, and three against the introduction of machinery: The moral of these statistics is pithily presented in three conclusions, namely: "Strikes generally prove powerless to benefit the condition of the wages class; they tend to deprive the strikers of work; they lead to improvidence, and are demoralizing in their effect upon the working man." Reference is made to the strikes in Great Britain and Ireland during 1877–78. They aggregate 468, of which less than 20 were successful and only about 30 were settled by compromise.

MALLEABLE BRONZE.—M. Dronier has patented in Germany a process for rendering bronze as malleable as copper. About 1 per cent of mercury is added to the tin in a warm state, and this is then mixed with the melted copper.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

A Mechanical Engineer, thorough mechanic and draughtsman, desires engagement. Pumping and hydraulic machinery a specialty. Address Hydraulics, Box 773, New York city.

Many of the largest and finest structures in this country are painted with H. W. Johns' Asbestos Liquid Paints, which are rapidly taking the place of all others for the better classes of dwellings, on account of their superior richness of color and durability, which render them the most beautiful as well as the most economical paints in the world. H. W. Johns' M'f'g Co., 87 Maiden Lane, New York, are the sole manufacturers.

Stationary, Paddle, and Propeller Yacht Engines, Propeller Wheels, etc. W. J. Sanderson, Syracuse, N. Y

Judson's Sectional Assay Furnaces. Muffles 6 x 12 and 9 x 15 in. W. E. Judson, Cleveland, O.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather. Greene, Tweed & Co., N.Y.

We will purchase or manufacture on royalty, patented articles of real merit. Farley & Richards, Phila., Pa.

Wanted—A Button Machine that will draw and pierce a tin blank; second-hand; give price; also tin blanks and strips wanted. Opal Ware Co., 323 Chestnut St., Philadelphia, Pa.

Peck's Patent Drop Press. See adv., page 173.

Nickel Solution for dipping. Only boiling; no battery; no royalty. Fine coating; stands polishing. Half gallon sample cans sent on receipt of $1. Recipe, $5. Reliable gold, silver and copper dips. Recipe. $2 each. A. Lovie, 92 N. Broadway, Baltimore, Md.

All kinds Machine Drawings. Inventors' work a specialty. Office hours 9 to 6. 733 Broadway, 3d floor front.

Vertical & Yacht Engines. T.P.Pemberton, 276 Water St., N. Y.

Brick Presses for Fire and Red Brick manufactured at 309 S. Fifth St., Phila., Pa. S. P. Miller & Son.

Having bought the Forsythe Scale Works here, we offer our present manufactory, with 25 H. P. engine and boiler, for sale. This property is well situated for manufacturing, only three blocks from depot. Will be sold low. Waukegan, Ill., is 35 miles north of Chicago. Full description sent on application. Powell & Douglas, M'f'rs Pumps and Windmills, Waukegan, Ill.

Spokes and Rims, white oak and hickory, best quality, to any pattern, and Hammer Handles of best hickory. John Fitz, Martinsburg, West Va.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Linen Hose and Rubber Hose of all sizes, with or without coupling. Greene, Tweed & Co., New York.

Brass & Copper in sheets, wire & blanks. See ad. p. 173.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes. Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Forsaith & Co, Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T.Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 157.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Silent Injector, Blower, and Exhauster. See adv. p. 173.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N.Y.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

All makes and sizes of Steam Hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

For Superior Steam Heat. Appar., see adv., page 172.

Valve Refitting Machine. See adv., page 174.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 174.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

New Economizer Portable Engine. See illus. adv. p. 174.

Fine Taps and Dies in Cases for Jewelers, Dentists, and Machinists. Pratt & Whitney Co., Hartford, Conn.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., and 93 Liberty St., N. Y city, U.S.A.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 177. Totten & Co., Pittsburg

NEW BOOKS AND PUBLICATIONS.

CIVILIZATION: IS ITS CAUSE NATURAL OR SUPERNATURAL? Philadelphia: Chas. H. Marot. 8vo, pp. 140.

The author describes himself as a wayfarer in search of the truth, but it is very clear that he had made up his mind on that score long before he began these sermon-like chapters. He holds the origin of civilization to be supernatural, and pronounces the theory of evolution a dream. Christianity, as popularly taught, he describes as no better than Darwinism; but holds, notwithstanding, that true Christianity is the sole foundation of human progress.

MINES OF MAINE, 1879–80. By F. L. Bartlett, State Assayer. Portland: B. Thurston & Co. Price 25 cents.

Describes the present condition and future prospects of the mines of Maine. Four years ago such a book would have been an impossibility, for there were then no developed mines in Maine. Now there are half a hundred in full operation, yielding gold, silver, and copper. Tin, zinc, arsenic, iron, nickel, and cobalt are also found. There is besides an abundance of non-metallic minerals of value; so that Maine promises soon to take rank among our great mining States. Mr. Bartlett's well made little book will be likely to attract much attention to these long-neglected sources of wealth.

REVISTA CIENTIFICA MEXICANA. Tomo I., Num. 1. Mexico, Diciembre de 1879.

We have here the first number of a New Mexican publication which gives promise of being a valuable addition to the already large list of journals devoted to general science. It contains an illustrated article on the "Different Species of Maguey (Agave) which are cultivated on the Plains of Apam and in the District of Cholula," by Professor Ignacio Blazquez; on the Aneroid Barometer, by Sr. Miguel Perez; on the Sierra Mojada," by Sr. Antonio G. Cubas; on the "Ores of Bismuth of Mexico," by Professor Mariano Barcena, and on "Cenozoic Porphyries," by the same; articles on the "Weather" and on "Geography," and various shorter scientific notes. In size the journal is quarto; the paper is good, the typography excellent, the articles are well written, and the editors have our best wishes for the success of their venture.

SALISBURY'S NEW PHYSICAL SIGN OF SYPHILIS. By Ephraim Cutter, M.D. Reprinted from the *American Journal of Dental Science*. 12mo., paper, pp. 12.

A verification of Dr. Salisbury's discovery of the fungoid origin of syphilis.

A TREATISE ON THE HORSE AND HIS DISEASES. By B. J. Kendall. Enosburg Falls, Vt.: J. B. Kendall & Co. 16mo, paper, pp. 89.

Contains an "index of diseases," with directions for treatment, a list of drugs used by farriers, and a large number of recipes, etc.

RELATIONS OF EDUCATION AND INDUSTRY TO CRIME AND PAUPERISM. By Henry W. Lord. Lansing, Mich: W. S. George & Co.

This is an address by the Secretary of the Michigan State Board of Charities to the Michigan Superintendents of the Poor in their sixth annual convention. Mr. Lord takes the ground that idleness is more demoralizing than ignorance, and supports it with a sufficient array of fact and logic to justify his opposition to the provision of the Michigan constitution forbidding the teaching of mechanical trades in the State prison.

THE FRANCO-AMERICAN TREATY OF COMMERCE. Pamphlets by Leon Chotteau. New York and Paris.

1. Reports and resolutions relative to a treaty of commerce between the United States and France, adopted in the Chambers of Commerce of the United States and France. 2. Report by Leon Chotteau, delegate of the French committee, of his two campaigns in the United States to secure a lowering of the customs tariffs of France and America, with an introduction by the Secretary of the French Committee, Auguste Desmolins. 3. Translation of "My two Campaigns."

RECENT GOVERNMENT REPORTS. United States. Washington: Government Printing Office.

United States Commission of Fish and Fisheries. Part V. Report of the Commission for 1877. Annual Report of the Secretary of the Treasury on the State of the Finances for the year 1879. Annual Report of the Director of the Mint for 1879. Statistical Abstract of the United States, first number, 1878, Bureau of Statistics. Annual Report of the Chief of the Bureau of Statistics for 1879. Quarterly Report of the Bureau of Statistics relative to imports, exports, immigration, and navigation, to June 30, 1879. Annual Report of the Operations of the United States Life Saving Service for 1878.

REPORT ON EXPERIMENTS IN BOILER BRACING. U.S. Navy Department, Bureau of Steam Navigation. Washington: Government Print.

Contains plates, tables, etc., with a short résumé of the work and results of a series of test experiments to determine the value and resistance of screw stay bolts for boilers under different conditions, using iron, steel, and copper plates of different thicknesses, etc. Bolts not riveted drew out at an average strain of 32,785 lb.; those riveted with the ordinary low conical head required an average strain of 35,033 lb. to draw them through the plate, the rivet head giving an additional strength of 2,248 lb. to a 1 inch stay bolt. The gain in favor of the button head bolt over the ordinary conical head ranged from 23 to 36 per cent.

THE NEW DEPARTURE IN THE COMMON SCHOOLS OF QUINCY. By Charles F. Adams, Jr. Boston: Estes & Lauriat. Price 25 cents.

Contains three papers: 1. The Public Library and the Public Schools; 2. Fiction in Public Libraries and Educational Catalogues; 3. The New Departure in the Common Schools of Quincy, Mass. The new departure is in a direction which the SCIENTIFIC AMERICAN has long advocated, and the results are of such importance as to call for a fuller consideration than there is space for here.

VAN NOSTRAND'S SCIENCE SERIES. New York: D. Van Nostrand. Price 50 cents.

The recent addition to this series of reprints are as follows: No 47. Linkages; the different forms and uses of Articulated Links; by J. D. C. DeRoos. No. 48. Theory of Solid and Braced Elastic Arches, applied to arch bridges and roofs in iron, wood, concrete, or other material; Graphical Analysis; by Wm. Cain, C.E. No. 49. On the Motion of a Solid in a Fluid, and the Vibration of Liquid Spheroids; by Thos. Craig, Ph.D.

HOW AND WHEN THE WORLD WILL END. By Rev. Joseph Wild, D.D. New York: James Huggins, 372 Pearl street.

A course of sermons delivered in a popular church in Brooklyn, the title of the book being that of the last discourse. The entire series is remarkable for the evidence it furnishes of the survival of a phase of culture that most men imagine to have long since passed away.

THE WORLD'S TIME.

A table showing equivalent local time every ten minutes during the day at prominent cities in the Eastern and the Western Hemisphere. Issued by the Baltimore and Ohio Railroad Company, 315 Broadway, N.Y.

VAN NOSTRAND'S ENGINEERING MAGAZINE. Volume XXI. July to December, 1879. New York: D. Van Nostrand.

The bound volumes of this well conducted magazine include a wide range of original and selected articles of permanent value to engineers.

REPORT OF PROFESSOR SPENCER F. BAIRD, SECRETARY OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1878. Washington: Government Printing Office.

THE SMITHSONIAN INSTITUTION; JOURNALS OF THE BOARD OF REGENTS, REPORTS OF COMMITTEES, STATISTICS, ETC. Edited by Wm. J. Rhees. Washington: The Smithsonian Institution.

A documentary history of the origin and progress of the Smithsonian Institution, with collateral matter relative to its officers and their work.

THE SCIENTIFIC WRITINGS OF JAMES SMITHSON. Edited by Wm. J. Rhees. Washington: The Smithsonian Institution.

Embraces twenty-seven papers contributed by the founder of the Smithsonian Institution to scientific periodicals between 1791 and 1825; with reviews of the scientific character of Mr. Smithson's writings by Professor W. R. Johnson and J. R. M. D. Irby.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Tomo IV. Nos. 6 and 7 Mexico, 1879.

The present double number of the Mexican Geographical Society's Bulletin, which has just come to hand, is mainly taken up with orations delivered by different members on the occasions of the two sessions held in honor of M. Thiers and of Father Secchi. The scientific paper in this issue is by Sr. V. Reyes, and entitled Statistico-Geographical Teachings as to mortality in the State of Morellos. This article, which must prove of considerable local interest and value, is illustrated with well executed colored charts showing the percentages of death in the different municipalities of the State from various prominent diseases. As with former numbers of this Society's publications, the general make up of the Bulletin is most excellent, and the taste displayed in the typography reflects great credit on the editors and printers.

PROTECTION OF FORESTS A NECESSITY. By S. v. Dorrien. New York: B. Westermann & Co. Paper, pp. 33.

Discusses the devastation of forests in Europe and the lessons learned therefrom, and argues that the protection of forests is a matter of immediate serious solicitude, the existence of forests being absolutely necessary to our national prosperity and life.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. B. W. asks: Would there be danger of springing or breaking a circular or crosscut saw with a press gummer, or would it be safer to use an emery wheel? A. We think it would be safer to use an emery wheel.

(2) W. H. C. asks: (1) In using insulated wire for secondary coil, in that described in your SUPPLEMENT, No. 160, how many layers are necessary to make a spark of about one inch? A. About 30. 2. Would not the extra current and its effects be increased if there were more layers (than two) in the primary? A. Not seriously. 3. Will not a carbon button pressed by a platinum tipped screw make a good commutator? A. No; the carbon will soon burn out. 4. What mixture is used on a copper disk for engraving glass? A. Emery and oil.

(3) F. F. writes: I am replating spoons which have been in use and become badly scratched. How can the surface be made smooth again most expeditiously? A. Use emery wheels of different forms and grades of fineness. 2. How is the fine polish seen on new work obtained? A. By burnishing.

(4) C. M. writes: In Vol. xli., No. 25, page 392, SCIENTIFIC AMERICAN, near the bottom of right hand column, I find this: "The concrete is composed of 5 parts sand and gravel as found in the river, 3 parts broken stone, and 1½ barrels Rosendale cement." In this case is the 1½ barrels taken as a unit? And is the composition made up of 1½ barrels cement; 3x1½, that is, 4½ barrels of broken stone; 5x1½, that is, 7½ barrels sand and gravel? When parts are spoken of, is weight or measure intended? When the expression parts is used, as in parts of a compound, parts of an estate, is anything definite said unless a definite unit is given? A. The constituents of concrete mixtures are generally measured. In compositions of matter, when parts are mentioned without reference to a definite unit, weights are usually implied. 2. What is the composition of the potato flour spoken of in the No. 5, present volume, page 72, as being extensively used for sizing and other purposes? A.

Composition of	Newly dug potatoes	Potatoes dried at 100° Fah.
Water	75·1 per cent.	
Starch	21·0 "	83·8
Albumen	2·3 "	9·6
Salts	1·0 "	4·1
Cellulose	0·4 "	1·7
Fatty matters	0·2 "	0·8
	100	100 (Wagner)

3. What is the composition of the thick and heavy fluid sold by the grocers under the name of golden sirup—it is retailed at about 80 cents per gallon? A. An aqueous solution of cane and inverted sugar and glucose, with a small quantity of sugar impurities.

(5) F. A. W. asks: Is there any way of cutting China or porcelain (vases, for instance) so as to leave a comparatively smooth edge to cut? I have a valuable pair of vases, the top edges of which are badly broken, and I desire to cut the flaring tops off, leaving a straight neck. Can you give me a simple way of cutting it? A. Place on a mandrel in a lathe a thin disk of copper or iron 3 inches in diameter. Supply it with rather fine emery and oil, and while revolving it at a speed of 400 or 500 revolutions per minute, hold the vase against the periphery of the disk. The disk should be often supplied with emery and oil.

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(6) C. A. B. asks how an egg (common hen's egg) can be put in a bottle, whose neck is smaller than the egg, and have the egg in perfect shape in the bottle. A. Soften the shell with acetic acid. It may subsequently be hardened by means of lime water.

(7) M. S. asks how the crystals on tin plate are got. I can bring out crystals with acid in the common way, or I can fuse the tin and cool by dashing cold water on it, then applying the acid. The first brings out a large coarse crystal, the second a small square star shape pattern. What I wish is different; it is called acid crystals, to distinguish from the other water crystals. It comes out equally brilliant on each side, as if the whole sheet was dipped in acid. Have tried nitric, muriatic, and sulphuric acids, both with salt and sal ammoniac, but without the required effect. A. Dip the warm plate in nitro-muriatic acid diluted with 2 volumes of soft water just long enough to develop the larger figures: then immediately plunge into a large quantity of cold water, after which dip in boiling water, which on removal will cause the plate to dry spontaneously. Lacquer immediately. A similar result is obtained by exposing the plate as it comes from the tin bath, and while the metal is still in a semi-fused condition, to jets of cold air for a few moments.

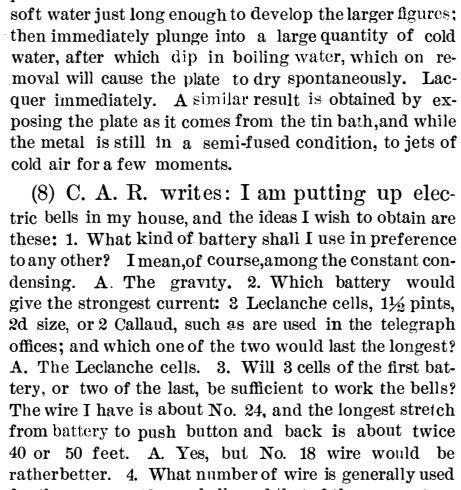
(8) C. A. R. writes: I am putting up electric bells in my house, and the ideas I wish to obtain are these: 1. What kind of battery shall I use in preference to any other? I mean, of course, among the constant condensing. A. The gravity. 2. Which battery would give the strongest current: 2 Leclanche cells, 1½ pints, 2d size, or 2 Callaud, such as are used in the telegraph offices; and which one of the two would last the longest? A. The Leclanche cells. 3. Will 3 cells of the first battery, or two of the last, be sufficient to work the bells? The wire I have is about No. 24, and the longest stretch from battery to push button and back is about twice 40 or 50 feet. A. Yes, but No. 18 wire would be rather better. 4. What number of wire is generally used for the magnet of house bells, and that of the connections from battery to button? A. Nos. 18 to 24. 5. Can Leclanche cells, I mean the porous cups, be refilled so as to possess the same power as when new? A. Yes. 6. If so, what is the best way to clean them? A. Soak them in warm water. 7. Must the oxide of manganese be pure, or is it better impure? Should it be powdered fine or coarse (like cracked corn)? A. It should be pure and granulated, or coarsely powdered. 8. Are the zinc rods better when amalgamated or not? Must they have a smooth or rough surface? A. They are more easily cleaned if smooth. They should be amalgamated. 9. Can you give me an idea of how I can make myself a small indicator of about 6 numbers? A. Cover each number with a small hinged cover arranged to drop by its own gravity. Hold this cover in place by a small catch. Attach to the catch an armature, and above the armature place an electro-magnet capable of raising the catch and the armature. Connect the wires of the magnet with the circuit, closing the device in the door or window to be indicated.

(9) W. L. W. writes: There are several bored salt wells in this section, sunk for drinking water, but cannot be used on account of the salt. One well yields a teacupful of salt to the gallon of water boiled down, say 1 lb. to the gallon. We wish to know if it will pay for the manufacture of salt. It is believed the water supply is inexhaustible at the depth of borings of 110 feet. A. The amount of salt would not permit of profitable working.

(10) F. X. W. asks: What substances can I use to make a paste or cement capable of withstanding boiling water, and at the same time soft, elastic, and pliable, used on felt and textiles, etc? A. Try a solution of gum caoutchouc in bisulphide of carbon. Dry under strong pressure.

(11) J. H. C. asks for the best way to test potato starch in regard to its quality. A. Microscopic examination is the best and quickest test, the size, shape, and markings of the granules of different kinds of starch rendering their recognition quite easy, as well as distinguishing the starch from foreign matters. See Wagner's "Chemical Technology."

(12) D H. S. writes: My watch having stopped on the 16th day of Nov., and no other timepiece being at hand, I obtained time by the following process: In the evening a board having a straight edge was leaned against the cabin and aimed at the north star. A plumb line was then suspended from the edge of the board. From the almanac I learned that upon the 17th the sun would fall on noon mark at 11:45. The instant the shadow of edge of board coincided with plumb line I set my watch at the time mentioned, 11:45. My companions said the time was too slow, and so it seemed to me. Can the true mean time be obtained in the manner described above, and if not, what corrections are necessary? A. Your failure to get a true meridian line was owing to the fact that the pole star is only on the meridian twice in 24 hours, and these times change from day to day, by reason of the difference of siderial time given by the apparent diurnal motion of the stars and solar time given by the apparent daily motion of the sun. The pole star is twice daily at its extreme eastern and western elongations, 1½ degrees from the true north. He could have obtained his meridian line and by it have set his watch as follows: Set up a stick, A B, and on its end fasten a piece of tin perforated with a hole. Let the string of a plumb bob hang through the center of this hole, and thus get a point in the vertical, marked V in the diagram. About 9 A.M. mark the center of the image of the hole at D, then with the line, A D, as a radius, describe an arc of a circle, and when in the afternoon the image of the hole falls on this line, as at E mark, then the line, N S, which bisects the angle, D A E, is the true meridian.



(13) W. M. asks what the ingredients are used by Cooper and several other glue manufacturers to make common glue white. A. Use fine, clear stock, a little alum, steam heat, and vacuum boilers.

(14) W. C. writes: 1. The recipe for violet copying ink which you give in your SUPPLEMENT, No. 157, p. 2498, is not intelligible. Please inform me what the symbols 5B, BR, etc., mean. A. The terms are those used by dealers to designate particular shades of color. 2. Please inform me whether you have published a recipe for making the copying pad which is so much used. A. See p. 325, SCIENTIFIC AMERICAN, Vol. 41.

(15) G. H. J. asks: What solution of silver is precipitated in a granular metallic form, by immersing in it a plate of copper? A. Sulphate or nitrate.

(16) H. H. asks for a good receipt for dressing for shoes, such as is sold in bottles under title of "French dressing" for ladies' or misses' shoes. A. Logwood extract, 6 oz., dissolve in soft water 1 gallon; borax, 6 oz., dissolve in soft water 1 gallon, and add 1½ oz. shellac, boil to dissolve; bichromate of potash ⅜ oz., dissolve in soft water ½ pint, and add 3 oz. ammonia water. Mix all together.

(17) W. B. P. asks: What material can I fortify with, in making a copper plate stencil, by allowing nitric acid to "eat out" the letters? A. The etching ground commonly used is prepared by melting together equal parts of asphaltum, Burgundy pitch, and beeswax, stir to incorporate. If the ground is brittle, use more beeswax; if it drags, more asphaltum.

(18) D. C. M.—Consult Blodgett's "Climatology," Buchan's "Handbook of Meteorology," Dove's "Law of Storms," Espy's "Philosophy of Storms," Herschel's "Meteorology," Karentz's "Meteorology," Lardner's "Meteorology," Morris' "Meteorology," Jenkens' "Use of Barometers," etc.

(19) B. S. writes: I made a copying pad according to directions in your paper, and find it works well, except that the material wastes away very rapidly in the cleaning after use. How could I obviate this difficulty? A. Use a very little warm water instead of cold. The gradual wasting is unavoidable.

(20) J. C. L. asks: How shall I proceed to polish copallite to properly show the insects therein? A. Cut it with a fine saw, and polish with tripoli and a little oil, applied on kid or chamois skin.

(21) R. W. H. asks for a receipt for dyeing billiard balls? A. Black.—Boil in a strong aqueous solution of logwood extract, and then immerse in acetate of iron solution; repeat if necessary. Blue.—Immerse for some time in a dilute aqueous solution of sulphate of indigo partially saturated with potash. Green.—Dip the blued ivory in tin liquor for a few minutes, then in a hot saturated aqueous solution of fustic; or boil the iron in a solution of verdigris in vinegar. Yellow.—Use the tin mordant and a hot strained decoction of fustic. Red.—Use tin mordant, and steep in a decoction of Brazil wood or cochineal or both. Lac, under similar circumstances, produces scarlet.

(22) S. G. writes: 1. I am about making an engine to run a scroll saw. It requires about the same power to run the saw as a sewing machine. What would be the proper dimensions for the engine? A. About as small as you can make, say 1 inch cylinder by 2 or 3 inch stroke. 2. Would Babbitt metal be hard enough to make the cylinder? If not, is there any metal softer than iron that would do? A. Yes, but it would wear fast. Use a piece of mandrel drawn brass tubing.

(23) G. A. C. asks: 1. If a steam fire engine will throw a stream a distance of 160 feet through 100 feet of hose, the engine running at 150 revolutions a minute, will it throw as far through 1,000 feet of hose, the engine still making 150 revolutions per minute? A. Yes, but it will require much more engine power to overcome the friction of the water in the 900 additional feet of hose. 2. Please name a good work on the steam engine for one who is not a professional engineer. A. Bowne's "Catechism of the Steam Engine."

(24) W. H. asks: What is the best self-feeder for low pressure steam boiler (up to 10 lb.)? A. The old Watt water column and float.

(25) P. V. H. writes: I think that the trouble complained of by your correspondent W. H., 6 query, page 123, in your number of February 2 (received to-day), will be corrected, if he brings his return pipe for condensed water from radiators into the boiler below the level of the water. The noises made are due to the struggles between the steam and water, when this pipe is open sometimes to steam, making varying pressure as the quantity of condensed water varies. Having suffered myself from this trouble, I completely corrected it in this way. There is never the least noise now.

(26) S. G. M. asks: 1. Can you give me a description of the Blake transmitter? A. See p. 274, Vol. 40, SCIENTIFIC AMERICAN. 2. Will the Lyons transmitter (described in SUPPLEMENT No. 163) work without an induction coil? A. No.

(27) R. H. J. writes: I have a new steam kettle, cast iron, porcelain lined, which is supplied with steam by a ½ inch pipe; it is 10 feet from the boiler, and yet I can scarcely make water boil in it with 30 lb. of steam; what is the matter? A. You send insufficient data, but a few general remarks may throw some light on the trouble. To raise water from mean temperature (39° Fah) to boiling, it requires about one fifth its weight in steam to do it, making no allowance for loss of heat by radiation. To evaporate all the water from a steam kettle it will require at least its own (the water's) weight of steam. The waste or return water from a steam kettle should not be taken to the same steam trap as the water from the heating apparatus, for the great shrinkage, that is, rapid condensation, due to the steam coming in contact with a large body of water through the sides of the kettle, will cause the condensed water to back up and fill the steam space. Theoretically it will take about 2½ minutes to boil a cubic foot of water, assuming all the steam that can pass through a ½ inch pipe at 30 lb pressure can be utilized in the same time. Thus, if you have a 75 gallon kettle it will take 25 minutes to heat all the water to 212° Fah. with steam through a ½ inch pipe, making no allowance for transmission through the iron, the slowness of convection of the water, and loss by radiation, and this under the most favorable circumstances of piping and trapping. When ebullition begins all the water in a kettle has not yet reached 212°. The baking of about ⅛ of an inch of mush on the bottom of a kettle, for the want of stirring when the meal was first put in, prevented the proper cooking of the food for 10 hours, and eventually it had to be removed to another and clean kettle.

(28) R. D. G. asks: 1. Do you know of any gear cutters which can be attached to a lathe? A. There are gear cutters made to be attached to a lathe for cutting small wheels. 2. I would like to know the easiest method for getting the diameter of a wheel when the pitch and number of cogs are given. A. Multiply the pitch by the number of teeth; the product is the circumference of the wheel at the pitch line.

(29) H. H. & Co., referring to our reply to F. A. S. on p. 124, current volume of SCIENTIFIC AMERICAN, write: The Bessemer steel from which railway rails are made contains from 35 100 to 45-100 of one per cent of carbon, and if mould boards and scraper bottoms are made of such steel, they can be hardened. These articles are made every day by all steel works from such material when asked for. Of course the degree of hardness will not be equal to the special plow steels made by the crucible method. Sheet steel for shovels, spring steel for carriage springs, etc., are rolled from Bessemer ingots when buyers require a cheap article.

(30) J. R. asks for a work on steam fitting similar to Mr. Baldwin's "Hints to a young Steam Fitter." A. We do not know of a work exclusively devoted to the subject. 2. What is the best length for a tubular boiler to burn hard coal, 12 or 14 feet; and the best size tube, 3½ or 4 inch; draught is good. A. If you use 3½ inch tubes you can make the boiler 12 feet, but with 4 inch tubes it should not be less than 14 feet. In either case it may be made 2 feet longer with advantage.

(31) R. C. M. asks (1) for a rule for finding the horse power of engines. A. Square the diameter of the cylinder, multiply the product by 0·7854. Multiply this product by the average pressure of steam per square inch on the piston, and this result by the number of feet the piston travels per minute, and divide by 33,000, the quotient is the horse power. 2. What is the rule for finding the horse power of a tubular boiler? A. For a tubular boiler allow 15 to 17 feet heating surface for each horse power. 3. What is the name of the newest and best book on the blast furnace? A. Schinz on "The Action of the Blast Furnace."

(32) J. L. writes: 1. In your issue of February 7, 1880, question No. 1, you advise hydraulic cement properly mixed to stop leaks in legs of locomotive boiler corroded by salt or lye. How is it to be mixed? Are you not advising the party to get up a first class explosion; one that will make that boiler throw a somersault similar to a locomotive boiler which exploded inside of Rogers' Works in Paterson, N. J., in 1852? A. Mixed like ordinary hydraulic lime mortar, small pieces of broken bricks put on to fill up space, there is no danger if the top is kept properly below the fire line. It has been used successfully in a number of cases. 2. What do you consider the best packing or joint for use between cast iron steam dome and top of portable boiler? A rust joint or soft cement composed of lead, oil, and borings, as per "Wrinkles and Recipes," pages 135 and 136? A. If the surfaces are true and faced, use the soft cement; if rough and untrue, make a rust joint.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. F. B.—It is pyrolusite—binoxide of manganese. The powdered mineral is commercially known as manganese, also as black oxide of manganese. It is largely used in the manufacture of bleaching powder or chloride of lime (calcium hypochlorite) and in glass making.—S. D.—We cannot judge fairly of the value of your water from so small a sample. The cost of a full quantitative analysis of a mineral water would be about $100.—M. M.—The ore is undoubtedly rich in silver; it is free milling.—J. F. S.—The sample of boiler incrustation consists chiefly of sulphate and carbonate of lime, oxide of iron, silica, alumina, and organic (carbonaceous) matter. The use of small quantities of tannate of soda has been found efficacious in preventing the formation of hard incrustations. Filter the water and use the blowout frequently.—W. S. B.—Crystals of rose and amethystine quartz, sometime used in jewelry. They are of little value. No. 2. It is chlorite in quartz, possibly auriferous.—L. M. C.—They consist chiefly of carbonate of lime with small quantities of clay, quartz, sulphide of iron, and lime phosphate.

English Patents Issued to Americans.

From February 13 to February 17, inclusive.

Anæsthetic compound, T. A. Edison, Menlo Park, N. J.
Bookstand, F. G. Johnson, Brooklyn, N. Y.
Dyeing, G. G. Smith, St. Albans, Vt
Electric lamp, T. A. Edison, Menlo Park, N. J.
Electric light, T. A. Edison, Menlo Park, N. J.
Flue cleaner, R. Atherten *et al.*, Paterson, N. J.
Gas, manufacture of, H. Y. Attrill *et al.*, New York city.
Oil still, E. Watson, Buffalo, N. Y.
Printing calico, F. Baylies *et al.*, New York city.
Railroad rails, A. J. Gustin, Boston, Mass.
Refrigerating apparatus, S. B. Hunt *et al.*, N. Y. city.
Telegraph, electric, B. Thompson *et al.*, Toledo, Ohio.
Wood-cutting tool, F. Hanson, Hollis, Me.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 17, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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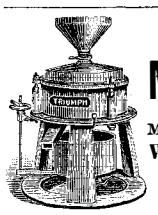

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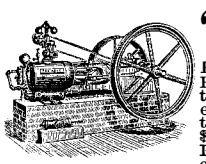

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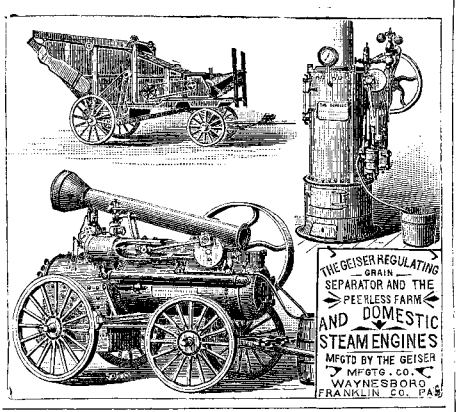
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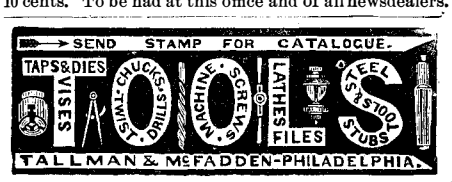

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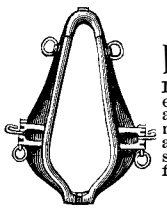

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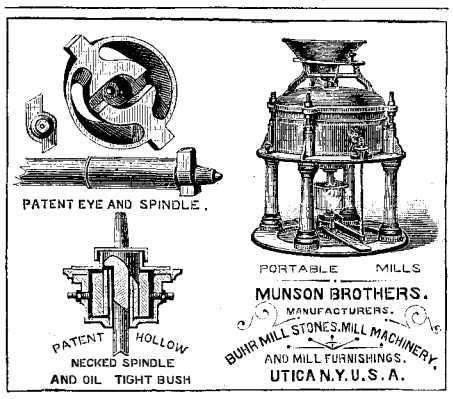

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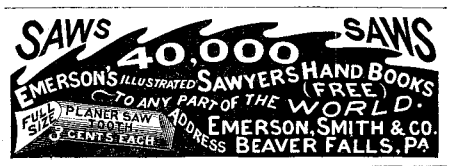

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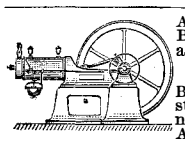

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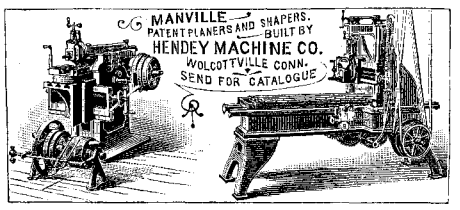

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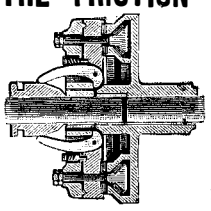

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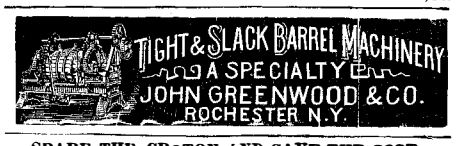

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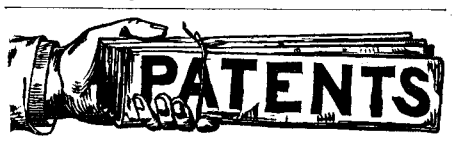

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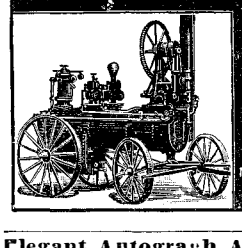

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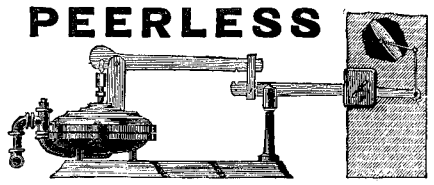

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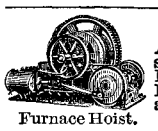

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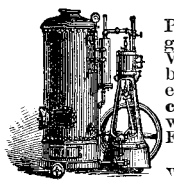

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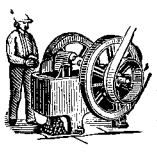

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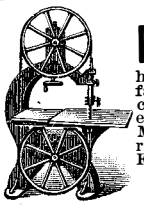

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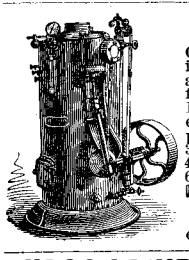

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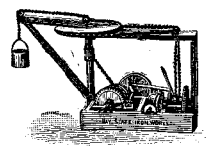

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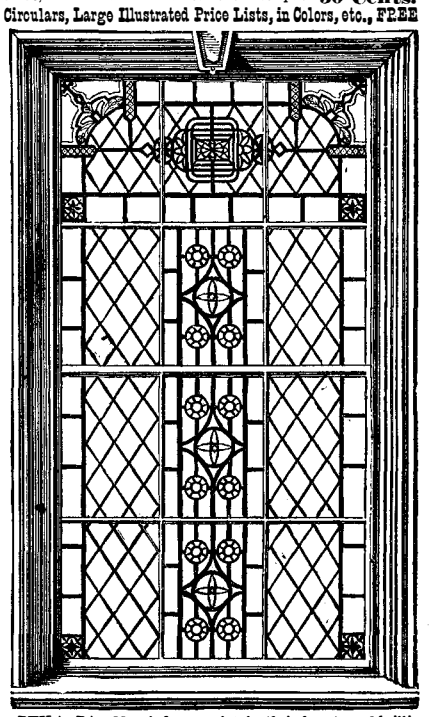

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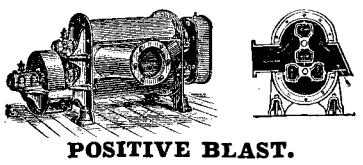

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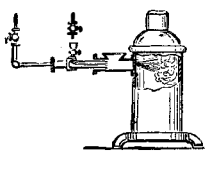

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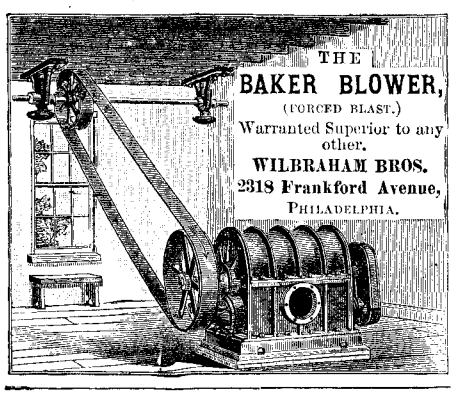

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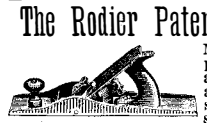
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